Bio-Optics: Design and Application (BODA)

April 4-6 2011, Hyatt Regency Monterey, Monterey, California, United States

Bio-Optics: This topical meeting will focus on design, fabrication, instrumentation, and applications of optical technologies for the life sciences. Topics cover general bio-optics in research and clinical application. Themes include but are not limited to visual optics, eye imaging and sensing, bio-inspired optics, optical biochip, optofluidics, biomedical and drug discovery imaging, biosensors, and other novel optical technologies for diagnosis and treatment. This conference is intended to be a highly interdisciplinary forum of discussion for researchers and engineers from academia and industry to discuss the design and application of bio-optics in life science.

Papers are being considered in the following topic categories:

- Visual optics
- Eye imaging and sensing
- Bio-inspired optics
- Optical biochip, optofluidics, biosensors
- Biomedical and drug discovery imaging
- Optical technologies for diagnosis and treatment

View the conference program and plan your itinerary for the conference

- Browse speakers and the agenda of sessions
- Browse sessions by type or day.
- Search by author, title, OCIS code and more.
- Plan and print your personal itinerary before coming to the conference

General Chairs

Guoqiang Li, Univ. of Missouri at St Louis, USA
Ronguang Liang, Carestream Health, USA

A number of distinguished invited speakers have been invited to present at the meeting.

This event is part of the Optics in Life Sciences Congress, allowing attendees to access to all meetings within the Congress for the price of one and to collaborate on topics of mutual interest.

Optics in the Life Sciences: OSA Optics and Photonics Congress

- Optical Trapping Applications (OTA)
- Novel Techniques in Microscopy (NTM)
- NEW! Bio-Optics: Design and Application (BODA)
- NEW! Optical Molecular Probes, Imaging, and Drug Delivery (OMP)
Optics in the Life Sciences: OSA Optics and Photonics Congress

April 4-6 2011, Hyatt Regency Monterey, Monterey, CA, USA

Agenda of Session Now Available!

Significant advances in the development of optical techniques have led to an ever increasing role of optics in the study of and treatment of various problems in the life sciences ranging from molecular level investigations to clinical treatment of patients. In this Congress, the latest advances in molecular probe development, life science imaging, novel and more powerful optical instrumentation and its application to study fundamental biological processes and clinical investigations will be presented. This progress in instrumentation development and its rapid application represents important enablers that permit studies not possible a few years ago. The upcoming group of meetings is a forum designed to report on this progress and brings together leaders in the field whose contributions are significantly advancing the state of the art in biological and medical research through the use of optical technologies.

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The Optics in the Life Sciences congress features the following meetings:

- Optical Trapping Applications (OTA)
- Novel Techniques in Microscopy (NTM)
- NEW! Bio-Optics: Design and Application (BODA)
- NEW! Optical Molecular Probes, Imaging, and Drug Delivery (OMP)

Be sure to add this exhibit to your marketing calendar. This Congress provides you an audience of over 300 scientists focused on optics in the life sciences. For information about reserving exhibit space, please call +1 202.416.1474 or email exhibitsales@osa.org. Sign up early to maximize your location.

Sponsor:

OSA
Bio-Optics: Design and Application (BODA)

April 4-6 2011, Hyatt Regency Monterey, Monterey, California, United States

Program

The Bio-Optics: This topical meeting will focus on design, fabrication, instrumentation, and applications of optical technologies for the life sciences. Topics cover general bio-optics in research and clinical application. Themes include but are not limited to visual optics, eye imaging and sensing, bio-inspired optics, optical biochip, optofluidics, biomedical and drug discovery imaging, biosensors, and other novel optical technologies for diagnosis and treatment. This conference is intended to be a highly interdisciplinary forum of discussion for researchers and engineers from academia and industry to discuss the design and application of bio-optics in life science.

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- Visual optics
- Eye imaging and sensing
- Bio-inspired optics
- Optical biochip, optofluidics, biosensors
- Biomedical and drug discovery imaging
- Optical technologies for diagnosis and treatment

A number of distinguished invited speakers have been invited to present at the meeting. In addition, the organizers have planned a number of special events to make your meeting experience more enjoyable!

View the conference program and plan your itinerary for the conference

- Browse speakers and the agenda of sessions
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Special Events

Welcome Reception
Poster Sessions
Post Deadline Sessions

For more information about Monterey, please visit the Housing and Travel page.
Optics in the Life Sciences: OSA Optics and Photonics Congress

Exhibit: April 4-6, 2011 at The Hyatt Regency Monterey in Monterey, CA USA

The Optics in Life Sciences: OSA Optics and Photonics Congress provides a forum where speakers present the latest results in the life sciences arena ranging from design and fabrication of bio-optics to the coverage of optical trapping schemes. This Congress is composed of six complimentary co-located meetings dealing with the most recent, high impact advances in the area of optics in life sciences. Approximately 300 Attendees expected:

- Optical Trapping Applications
- Novel Techniques in Microscopy
- Bio-Optics Design and Application
- Optical Molecular Probes and Imaging

Monterey County highlights everything that's best about California. From seaside restaurants to the Salinas Valley’s hillside vineyards, from Big Sur's redwood groves to Pebble Beach’s perfectly groomed golf courses, from Salinas’ old-fashioned rodeo to Carmel-by-the-Sea’s elite music and art festivals, Monterey has a feast of fun just waiting to be sampled.

For More Information about Reserving Exhibit Space at OSA Meetings, please call +1 202.416.1474 or email exhibitsales@osa.org

If you are already an exhibitor and you have questions about shipping, ordering furnishings or services and/or have any other logistically related questions, please call +1 202-416-1972 or topicaledits@osa.org.
Optics in the Life Sciences:
OSA Optics & Photonics Congress 2011

Bio-Optics: Design and Application (BODA)
Novel Techniques in Microscopy (NTM)
Optical Molecular Probes, Imaging, and Drug Delivery (OMP)
Optical Trapping Applications (OTA)

4–6 April, 2011
Monterey, CA, USA

Conference Program
Welcome to the 2011 Optics in the Life Sciences: OSA Optics and Photonics Congress! This congress has two veteran topical meetings, Novel Techniques in Microscopy (NTM) and Optical Trapping Applications (OTA) and two new meetings, Bio-Optics: Design and Application (BODA) and Optical Molecular Probes, Imaging, and Drug Delivery (OMP) which promise to be exciting and informative first-ever meetings on these fascinating topics. We hope that bringing together leaders and experts among the different communities to share information and discuss topics across the disciplines of optical science and engineering will provide you with a rich experience in Monterey.

The focus of the BODA meeting is on design, fabrication, instrumentation, and applications of optical technologies for the life sciences. Themes include but are not limited to visual optics, eye imaging and sensing, bio-inspired optics, optical biochip, optofluidics, biomedical and drug discovery imaging, biosensors, and other novel optical technologies for diagnosis and treatment. This meeting is intended to be a highly interdisciplinary forum of discussion for researchers and engineers from academia and industry to discuss the design and application of bio-optics in life science. This inaugural meeting’s program boasts 30 well-known invited speakers, 23 contributed speakers and 7 posters.

The NTM Meeting emphasizes new advances and strategies that push back the limits in microscopic imaging, leading to improvements in resolution, speed, depth penetration, versatility, etc., as well as novel modalities and contrast mechanisms. The primary focus is on techniques rather than applications, with the goal of providing a forum for the interaction of inventors in optical microscopy, researchers and students, and industrial participants. NTM’s exciting program consists of a total of more than 60 papers, with 13 invited speakers, 40 oral presenters and 8 poster presentations.

As one of the inaugural meetings in the congress, the OMP topical meeting focuses on the optical detection and localization of molecular processes that occur at low concentrations in vivo. Topics include experimental and computational approaches for generating adequate contrast between a target and the surrounding tissue, which is essential for accurate disease diagnosis, as well as monitoring drug delivery and treatment response. This meeting will highlight recent advances in this rapidly evolving area of research with a goal of stimulating new ideas toward clinical translation. OMP’s exciting program consists of a total of more than 40 papers, with 14 invited speakers, 22 oral presenters and 5 poster presentations.

The OTA topical meeting explores the applications of novel optical trapping and manipulation techniques, including the use of evanescent fields, plasmonics, microfluidics, integrated lab-on-a-chip technologies, parallel optical sorting, innovation in optical methods for cellular biology and the current state of the art in fundamental concepts of optical trapping. During the course of 2 days, we will present an exceptional program with 15 invited speakers, 24 oral presentations and 12 poster presentations demonstrating cutting-edge research and technology.
We all are pleased to have you join us and look forward to your continued participation in these topical meetings.

**BODA**
Guoqiang Li, *Univ. of Missouri at St Louis, USA*, **General Chair**
Ronguang Liang, *Carestream Health, USA*, **General Chair**

**NTM**
Jerome Mertz, *Boston Univ., USA*, **General Chair**
Eric Potma, *Univ. of California at Irvine, USA*, **General Chair**

**OMP**
Mary-Ann Mycek, *Univ. of Michigan, USA*, **General Chair**
Konstantin Sokolov, *UT M.D. Anderson Cancer Ctr., USA*, **General Chair**

**OTA**
Carlos Lopez-Mariscal, *US Naval Res. Lab., USA*, **General Chair**
David McGloin, *Univ. of Dundee, UK*, **General Chair**
<table>
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<tr>
<th>Time</th>
<th>Sunday, 3 April, 2011</th>
<th>Monday, 4 April, 2011</th>
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<td>BODA</td>
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<td>BMA • Adaptive Optics for the Eye</td>
<td>NMA • Superresolution I (starts at 8.15)</td>
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<td>15.00–18.00 Registration Open, Regency Foyer South</td>
<td>BMD • Optical Biosensors II</td>
<td>NMD • Nonlinear II (ends at 17.45)</td>
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## Key to Agenda

- **BODA**: Bio-Optics Design and Application
- **NTM**: Novel Techniques in Microscopy
- **OMP**: Optical Molecular Probes, Imaging and Drug Delivery
- **OTA**: Optical Trapping Applications
- **OTA**: Optical Trapping Applications
- **Joint Sessions**

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### Tuesday, 5 April, 2011

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<td>10.00–10.30</td>
<td>Coffee Break, Regency Main</td>
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<td>10.00–16.00</td>
<td>Exhibits Open, Regency Main</td>
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<tr>
<td>13.30–15.30</td>
<td>JTuA • Joint Poster Session, Regency Main</td>
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<td>15.30–16.00</td>
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### Wednesday, 6 April, 2011

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<td>10.00–10.30</td>
<td>Coffee Break, Regency Main</td>
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<tr>
<td>10.00–16.00</td>
<td>Exhibits Open, Regency Main</td>
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<tr>
<td>13.30–15.30</td>
<td>BWC • Spectroscopic Imaging (ends at 3:45pm)</td>
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**Notes**

- **Joint Sessions**
  - **BODA** • Bio-Inspired Optics
  - **NTM** • Imaging Through Tissue
  - **OMP** • Advances in Instrumentation or Algorithms II
  - **OTA** • Trapping Techniques and Applications I
  - **BODA** • Design for Biomedical Optical Imaging
  - **NTM** • Optical Molecular Probes, Imaging and Drug Delivery (OMP)
  - **OTA** • Optical Trapping Applications
  - **NTM** • New Techniques

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**Breaks**

- Lunch Break (on your own)

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**Registration**

- 7.00–15.30, Regency Foyer South
- 7.00–18.00, Regency Foyer South

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**Exhibits**

- 10.00–16.00, Regency Main

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**Joint Sessions**

- **BODA**
- **NTM**
- **OMP**
- **OTA**

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**Contact**

For more information, contact:

- [Name of Contact]
- [Email Address]
- [Phone Number]
BMA • Adaptive Optics for the Eye
Monday, 4 April
8:00–10:00
Presider to Be Announced

BMA1 • 8.00 Invited
History and Future of Ophthalmic Adaptive Optics, Pablo Artal; Univ. de Murcia, Spain. Adaptive optics allows the simultaneous measurement and manipulation of the eye’s aberrations. Some of the recent history, together with my personal views of the future will be covered in the presentation.

BMA2 • 8.30 Invited
Advanced Optical Techniques for Clinical and Basic Vision Science, Austin J. Roorda1, Lawrence C. Sincich1, Qiang Yang1, David W. Arathorn1, Pawan Tirawatbula1, William S. Ticer2; 1School of Optometry, Univ. of California at Berkeley, USA; 2Dept of Ophthalmology, Univ. of California at San Francisco, USA. A system that records microscopic retinal video while delivering ultra-sharp stimuli to targeted retinal locations is described. The precision of the stimulus presentation to living retina enables an unprecedented level of control for vision research.

NMA • Superresolution I
Monday, 4 April
8.15–10.00
Michael Thompson; Stanford Univ., USA, Presider

NMA1 • 8.15 Invited
Advances in Super-Resolution Biplane FPALM, STED and 3-D Particle Tracking Microscopy, Jörg Beversdorff, Yale Univ.; USA. STED and FPALM microscopy generate super-resolution images at -25 nm resolution through targeted and stochastic switching of fluorophores. I present recent advances in both techniques and introduce a novel ultra-fast 3D particle-tracking microscope.

NMA2 • 8.45
Benchmarking Image Analysis Algorithms for Superresolution Fluorescence Microscopy, Forrest Huppenreiter; Alexander R. Small, California State Polytechnic Univ., USA. We demonstrate a method of benchmarking to identify optimal rejection algorithms for superresolution fluorescence microscopy. Simulations show that a minimum photon count of ~3/4 the mean photon count per molecule yields acceptable performance.

OMB • Novel Probes I
Monday, 4 April
8.00–10.00
Mary-Anne Mycek; Univ. of Michigan, USA, Presider

OMA1 • 8.00 Invited
Photoacoustic Tomography: Ultrasonically Breaking through the Optical Diffusion Limit, Li Hong Wang; Biomedical Engineering, Washington Univ. in St. Louis, USA. Photoacoustic tomography measures optical absorption through detection of photoacoustic waves. The optical diffusion limit, defined by the transport mean free path, on penetration for high-resolution optical imaging is broken.

OMA2 • 8.30 Invited
Simultaneous Morphological and Biochemical Imaging for Cancer Diagnosis and Atherosclerotic Plaque Discrimination, Brian E. Applegate; Texas A&M Univ., USA. We have developed a high-speed integrated OCT/FLIM imaging system to acquire morphological and biochemical images. System development and results from recent studies for cancer detection and atherosclerotic plaque discrimination will be discussed.

OMA3 • 8.45
Bowtie Nanomaterials for Plasmonic Optical Trapping, Brian J. Roxworthy1,2, Kaspar D. Ko1, Anil Kumar1, Kin Hung Fung1, Gang Logan Liu1, Nicholas Yang1, Kimani C. Toussaint1,2; Lab. for the Photonics Res. of Bio/nano Environments, Univ. of Illinois at Urbana-Champaign USA; 1Mechanical Science and Engineering, Univ. of Illinois at Urbana-Champaign, USA; 2Electrical and Computer Engineering, Univ. of Illinois at Urbana-Champaign, USA. Plasmonic optical trapping of polystyrene micron-sized spheres using Au bowtie nanomaterials is demonstrated. Conventional trapping constraints are greatly reduced, allowing for use of weak focusing and inexpensive sources (laser pointers).

OTMA • Nanomanipulation and Microfluidics
Monday, 4 April
8.00–10.00
David McGloin; Univ. of Dundee, Presider

OTMA1 • 8.00 Invited
Nanomanipulation Using Near Field Photonics, David Erickson; ’Sibley School of Mechanical and Aerospace Engineering, Cornell Univ., USA. I will present our recent work on the optical trapping and manipulation of nanomaterials using the near-field of integrated photonic devices. I will discuss two application areas namely: single molecule trapping and nanomanipulation.

OTMA2 • 8.30
Heating in Optically Trapped Gold Nanoparticles Measured in Artificial Membranes, Poul M. Benix1, Anders Kyrsting1, Nadir Rehmani1, Lene Oddershede1, Niels Bohr Inst., Univ. of Copenhagen, Denmark. We have developed lipid based assays which can measure the temperature of any nanoscale irradiated object. As a demonstration we apply this to gold nanoparticles irradiated by focused near infrared laser light.
### BMA • Adaptive Optics for the Eye—Continued

**BMA3 • 9.00 Invited**

**Three-Dimensional Cellular Resolution in *vivo* Retinal Imaging**, Robert J. Zawadzki, Saman Pili, Du Yu Kim, Sandra Balderas-Mata, Arlie G. Cappi, John S. Werner; *Ophthalmology & Vision Science, Univ. of California at Davis, USA.* Current developments in cellular resolution in-vivo retinal imaging systems at the UC Davis will be presented. Instrumentation developments include the combination of adaptive optics with optical coherence tomography and scanning laser ophthalmoscopy.

**NMA3 • 9.00 Invited**

Grating-Enhanced Coherent Imaging, Jeffrey P. Wilde, Joseph W. Goodman, Yomina C. Eldar, Yuzuru Takashima; *Electrical Engineering, Stanford Univ., USA; Electrical Engineering, Israel.* We describe a coherent imaging technique that utilizes a diffraction grating placed near the object to alias high spatial frequency information through the imaging system pupil. Linear signal processing is used to reconstruct high-resolution images.

**NMA4 • 9.15**

High-Resolution Total-Internal-Reflection Fluorescence Microscopy Using Periodically Nano-Structured Glass Slides, Emeric Mudry, Jules Girard, Kamal Belkebir, Hugues Giovannini, Patrick C. Chaumont, Anne Sentenac; *Inst. Fresnel, Aix-Marseille Univ., France.* Resolution of the optical fluorescence microscopy is improved up to fourfold thanks to a standing-wave structured-illumination, whose illumination field is created by a nano-structured glass slides.

**BMA4 • 9.30 Invited**

Title to be Announced, Jennifer Hunter; Univ. of Rochester; USA. Abstract not available.

**NMA5 • 9.30 Invited**

Hyperspectral Nanoscale Imaging on Dielectric Substrates with Coaxial Optical Antenna Scan Probes, Alexander Weber-Bargioni, Adam Schwartzberg, Matteo Cornaglia, Ariel Issac, Jeffrey Urban, Yufanle Pang, Reuven Gordon, Jeffrey Bokar, Miguel Salmeron, Frank Ogletree, Stefano Cabrini, Peter Jim Schuck; *Molecular Foundry, Lawrence Berkeley Natl. Lab., USA; Dept. of Electrical and Computer Engineering, Univ. of Victoria, Canada.* We have demonstrated hyperspectral tip-enhanced Raman imaging on dielectric substrates using reproducible nano-fabricated coaxial antenna tips, enabling Raman spectral imaging (chemical mapping) with high resolution (<20nm) shown on CNTs.

**OMA3 • 9.00 Invited**

Simultaneous, Dual-Color STORM Imaging of Membrane Reorganization during Early Immune Response, Jesse S. Aaron, Bryan D. Carson, Jerilyn Timlin; *Bioenergy and Defense Technologies, Sandia Natl. Labs, USA.* TLR-4 receptor reorganization in cell membranes was investigated using a novel STORM microscope. The increased resolution permits observation of receptor cluster formation following challenge with chemotypes of lipopolysaccharide.

**OMA4 • 9.30**

Whole-Cell Analysis of Cardiomyocytes with Combined Quantitative Phase and Two-Channel Fluorescence Microscopy, Matthew T. Rinnehart, Nathan T. Shaked, Lisa Sattersonhite, Adam Wax; *Biomedical Engineering, Duke Univ., USA.* We have developed a novel microscope combining quantitative phase and fluorescence microscopy to perform quantitative analysis of dynamic cardiomyocyte contraction. Phase-based parameters are informed by molecular specificity of fluorescence images.

**OTMA • Nanomanipulation and Microfluidics—Continued**

**OTMA4 • 9.00**

Temperature Measurements of Optically Trapped Gold Nanoshells, Brooke C. Hunter, Greitchen K. Campbell, Kristian Helsen, Ryan Huschta, Naomi Halas; *Physics and Astronomy, Appalachian State Univ., USA; Atomic Physics Division, NIST, USA; School of Physics, Monash Univ., Australia; Depts. of Chemistry and of Electrical and Computer Engineering, Rice Univ., USA.* We measure the temperature of an optically trapped gold nanoshell by tracking its Brownian motion. Single nanoshells are found to heat significantly, and this heating varies with trap wavelength and particle number.

**OTMA5 • 9.15 Invited**

Title to be Announced, Michal Lipson; Cornell, USA. Abstract not available.
### BIOSUR ROOM
**Bio-Optics: Design and Application (BODA)**

### REGENCY 1 & 2
**Novel Techniques in Microscopy (NTM)**

### REGENCY 3
**Optical Molecular Probes, Imaging and Drug Delivery (OMP)**

### CYPRESS ROOM
**Optical Trapping Applications (OTA)**

### NMA • Superresolution I–Continued

**NMA6 • 9.45**
*Imaging Beyond the Diffraction Limit by Electron-Beam Excited Assisted (EXA) Scanning Optical Microscope,*
Wataru Inami¹, Yasunori Nawa¹, Akito Chiba¹, Atsunori Miyakawa¹, Yoshimasa Kawai², Susumu Terakawa³, Atsushi Uno³; ¹Shizuoka Univ., Japan; ²Hamamatsu Univ. School of Medicine, Japan; ³CREST, Japan. We propose a new type of scanning optical microscope which has a few tens nanometer spatial resolution laterally and is possible to observe dynamic behaviors of a specimen in various surroundings.

### OMB • Novel Probes I–Continued

**OMA5 • 9.45**
*In vivo Estimation of Functional and Structural Characteristics in Epithelial Neoplasia,*
George Papoutsoglou¹; ¹Electronic & Computer Engineering, Technical Univ. of Crete, Greece. We have developed a method for estimating functional and structural characteristics in cervical neoplasia based on pharmacokinetic modeling of biomarker-tissue interaction and on the solution of the inverse problem through Global Optimization methods.

### OTMA • Nanomanipulation and Microfluidics–Continued

**OTMA6 • 9.45**
*Microfluidic Systems Combined with Optical Micromanipulation and Spectroscopy for Live-cell Analysis and Sorting,* Zdenek Pilat, Alexandr Jonas, Ota Samek, Jan Jezek, Mojmir Sery, Pavel Zemanek; Inst. of Scientific Instruments of the ASCR, Czech Republic. We have investigated a combination of optical trapping with microspectroscopic techniques and microfluidic chips for advanced biotechnological applications.

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**NOTES**

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<td>10.00–10.30</td>
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<td>Exhibits Open, Regency Main</td>
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<td>Room</td>
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| Big Sur Room | Bio-Optics: Design and Application (BODA)  | **BMB • Multi-Modality Optical Imaging**  
Monday, 4 April  
10.30–12.30  
Presider to Be Announced | **BMB1 • 10.30 Invited**  
**Title to Be Announced, Joseph Izatt; Duke Univ., USA.**  
Abstract not available. |
| Regency 1 & 2 | Novel Techniques in Microscopy (NTM) | **NMB • Superresolution II**  
Monday, 4 April  
10.30–12.30  
Joerg Bewersdorf; Yale Univ., USA, Presider  
**NMB1 • 10.30 Invited**  
Optical Tracking Microscopy and Super-Resolution Imaging of Living Cells Beyond the Diffraction Limit, W. E. Moerner; Stanford Univ., USA.  
Abstract not available. |
| Regency 3 | Optical Molecular Probes, Imaging and Drug Delivery (OMP) | **OMB • Novel Probes I**  
Monday, 4 April  
10.30–12.15  
Konstantin Sokolov; MD Anderson Cancer Center, Univ. of Texas, USA, Presiders  
**OMB1 • 10.30 Invited**  
**Title to Be Announced, Rebekah Drexel, Rice Univ., USA.**  
Abstract not available. |
| Cypress Room | Optical Trapping Applications (OTA) | **OTMB • Fundamental Systems**  
Monday, 4 April  
10.30–12.30  
Carlos López-Mariscal; NRL, USA, Presider  
**OTMB1 • 10.30 Invited**  
Optical Trapping and Cooling of Glass Microspheres, Mark G. Raizen1, Tongcang Li1, Simon Kheifets1, David Medellin1; 'Ctr. for Nonlinear Dynamics and Dept. of Physics, Univ. of Texas at Austin, USA. We report optical trapping of glass microspheres in air and vacuum, and measurement of Brownian motion of single microspheres at different pressures. We have also cooled the center of mass in vacuum to 2 mK. |

**BMB2 • 11.00 Invited**  
**Title to Be Announced, Galtekin Gulsen; Univ. of California at Irvine, USA.**  
Abstract not available.  
**NMB2 • 11.00**  
Three-Dimensional Super-Resolution Imaging with a Corkscrew Point Spread Function, Matthew D. Lew2, Steven E. Lee3, W. E. Moerner3; 'Electrical Engineering, Stanford Univ., USA; 1Chemistry, Stanford Univ., USA. We describe the design of a corkscrew point spread function for 3D super-resolution microscopy. To prove the principle, we image fluorescent beads on a patterned PDMS surface, achieving a localization precision of 3 nm in x, 2 nm in y, and 6 nm in z.  

**NMB3 • 11.15**  
Double-Helix PSF Microscopy with a Phase Mask for Efficient Photon Collection, Sean Quinlan, Gimi Goveer, Callie Felder, Rafael Pieten; Electrical, Computer and Energy Engineering, Univ. of Colorado, USA. We present the first implementation of double-helix phase masks for 3-D microscopy with high photon collection efficiency. The mask is fabricated using gray-level mask-less lithography. The system demonstrates precise 3-D tracking of quantum dots.  

**OMB2 • 11.00 Invited**  
Preliminary Intravital Microscopic Analysis Reveals Macrophage Uptake of Circulating Nanotubes and Peptide-Dependent Delivery into Tumor, Bryan R. Smith1, Harikrishna Rallapalli1, Jennifer Prescher1, Cristina Zavalea1, Jarrett Rosenberg1, Scott Tabakman1, Hongjie Dai1, Sanjiv S. Gambhir1; 1Radiology/Bioengineering, Stanford Univ., USA; 2Chemistry, Stanford Univ., USA. Nanoparticle targeting efficiency to tumor is poor and not well-understood. We applied intravital microscopy in a dorsal window chamber model to interrogate vasculature-targeted carbon nanotubes. We found that nanotubes program circulating macrophages to enter tumor.  

**OTMB2 • 11.00 Invited**  
Laser Cooling Optically Trapped Particles, Peter Barker; Univ. of College London, UK. In this talk I will report on the development of two methods to cool optically levitated objects. I will outline both cavity and Doppler cooling techniques and report on progress towards cooling particles in an optical fiber trap.
Fluorescence Lifetime Techniques in Multimodal Tissue Diagnostic Platform, Laura Marcu; Biomedical Engineering, Univ. of California Davis, Davis, USA. We overview fluorescence lifetime techniques for tissue diagnostics and approaches to merging these techniques with ultrasound backscatter microscopy and photocoustic imaging. Such hybrid system allow for complex tissue characterization at biochemical, morphological, and functional levels.

Polarimetry-Based Far-Field Method for High-Resolution Optical Microscopy, Oscar Rodriguez, David Lars, Chris Dartly; Applied Optics, School of Physics, Natl. Univ. of Ireland, Ireland; Blackett Lab., Imperial College London, UK. We present numerical and experimental results of a polarimetry-based far-field method for high-resolution optical microscopy. This method may be used to differentiate between a set of different sub-resolution objects with no need for active scanning.

Combining Optical Coherence Tomography (OCT) and Fluorescence Imaging: Technology and Applications, Yu Chen; Bioengineering, Univ. of Maryland, USA. I will present our efforts on the development of combining optical coherence tomography (OCT) with fluorescence imaging (including depth-integrated imaging and depth-resolved tomography) for simultaneous morphological and molecular imaging.

Resolution Enhancement in Confocal Scanning Microscopy by a Radially Polarized Beam with Phase Modulation, Yuchi Kanzawa, Shunichi Sato; Inst. of Multidisciplinary Research for Advanced Materials, Tohoku Univ., Japan. We evaluate spatial resolution in fluorescence confocal scanning microscopy using a radially polarized beam with concentric phase modulation. The enhancement of lateral resolution is predicted with side-lobe suppression due to a confocal aperture.

Two-Photon Fluorescence Vascular Imaging with a New Fluorene-RGD Peptide Conjugate, Alma R. Morales, Takeo Urakami, Masanobu Komatsu, Kevin D. Belfield; Chem. Dept. of Chemistry, Univ. of Central Florida, USA; Sanford-Burnham Medical Res. Inst. at Lake Nona, USA. Two-photon fluorescence microscopy is a powerful tool in the study of living cells, and tissue microvasculature. Herein, a 2PFM was conducted to evaluate the efficiency of a new 2PA conjugate designed to target αvβ3 integrins.
Using the time reversal concept, we show that isotropic focusing can be realized by placing a mirror after the focal point and shaping the incident beam. This idea is applied to axial resolution improvement in confocal microscopy.
### Big Sur Room
**Bio-Optics: Design and Application (BODA)**

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<td>BMC</td>
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<td>Optofluidic Nano-Plasmonics for Biosensing, Yeshaiahu Fainman; Univ. of California at San Diego, USA. We explore metal-dielectric nano-plasmonic structures for localization and resonant transmission of optical fields, investigate fabrication and integration of optofluidic nano-plasmonic systems and explore their applications for biochemical sensing.</td>
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### Regency 1 & 2
**Novel Techniques in Microscopy (NTM)**

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<td>Eric Potma; Univ. of California at Irvine, USA, Presider</td>
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<td>Nonlinear Coherent Optical Imaging by Stimulated Radiation Microscopy, Wei Min, Columbia Univ., USA. The emerging stimulated radiation microscopy, including stimulated Raman scattering and stimulated emission, provides distinct and powerful image contrasts for non-fluorescent species. Here we present its principles and biomedical applications.</td>
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### Regency 3
**Optical Molecular Probes, Imaging and Drug Delivery (OMP)**

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<td>Lihong Wang; Washington Univ. in St. Louis, USA, Presider</td>
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<td>OMC1</td>
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<td>Optical Redox Imaging of Endogenous Contrast for Tissue-Engineered Constructs, Wyman; Univ. of Michigan, USA; Dept. of Oral and Maxillofacial Surgery, Univ. of Michigan, USA. Endogenous fluorescence redox imaging was developed to noninvasively assess cell viability in 3-dimensional tissue-engineered constructs prior to implantation. A lower redox ratio was observed from samples with higher proliferation.</td>
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### Cypress Room
**Optical Trapping Applications (OTA)**

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<td>Mike MacDonald; Univ. Dundee, UK, Presider</td>
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<td>OTMC1</td>
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<tr>
<td></td>
<td>Optical Trapping Applications, Gijs Waite; Virje Univ., Amsterdam. Abstract not available.</td>
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**Optics in the Life Sciences Congress and Exhibition • 4–6 April, 2011**
Enhanced Engineering, Jiseok Fiber Surface 2 Bioengineering, Electrical George2, the Interactions, Eikhyun of design, Photonic Korea.

NMC • Nonlinear I–Continued

OMC • Clinical/Pre-clinical Applications I–Continued

OTMC • Analysis of Biological Systems–Contributed

BMC2 • 14.00
Surface Plasmon Resonance Optical Fiber Biosensor for Label-Free Characterization of Biomolecular Interactions, Yamina Shevchenko, Tariq Francis, Maria DeRosa, Jacques Albert; Carleton Univ., Canada. A fiber sensor was applied to monitor the interaction of biomolecules. Results indicate that the biosensor can be successfully applied for a wide range of biomolecular characterizations including identification of the biomolecules’ binding constants.

BMC3 • 14.15
The Effect of Nano Grating Shapes on the Sensitivity of Guided Mode Resonance Protein Sensor Fabricated by Nano Injection Molding Process, Eikhyun Cho1, Yuara Hee1, Myungki Jung1, Jiseok Lim1, Seokmin Kim1, Shinil Kang2; 1Mechanical Engineering, Yonsei Univ., Republic of Korea; 2Mechanical Engineering, Chung-Ang Univ., Republic of Korea. We investigated the effect of nano grating shapes on the sensitivity of nano injection molded guided-mode-resonance protein sensor. To confirm the profile effects, we performed design, fabrication and performance evaluation.

BMC4 • 14.30
Photonic Crystal Enhanced Microscopy: Multimode Imaging for Photonic Crystal Biosensors, Vikram Chaudhary1, Erich Lidstone1, Sherine George2, Cheng-Sheng Huang2, Anja Kohl2, Patrick Mathias2, Brian Cunningham2; 1Electrical and Computer Engineering, Univ. of Illinois Urbana-Champaign, USA; 2Bioengineering, Univ. of Illinois Urbana-Champaign, USA. Photonic Crystal Enhanced Microscopy (PCEM) utilizes the optical resonances of photonic crystal surfaces for label-free biosensor imaging and amplification of fluorescence. We describe the application of PCEM to biomolecular and cell-based assays.

BMC2 • 14.00
Picosecond CARS Spectral Imaging with Principal Component Analysis, Jeffrey L. Subahlin1,2, Ryan S. Lim1, Moshe Levy1, Bruce J. Tromberg1,2, Eric Potma1,2; 1Beckman Laser Inst. and Medical Clinic, Univ. of California at Irvine, USA; 2Department of Biomedical Engineering, Univ. of California at Irvine, USA; 3Department of Chemistry, Univ. of California at Irvine, USA; 4Division of Renal Diseases and Hypertension, Univ. of Colorado, USA. We demonstrate the utility of picosecond spectral coherent anti-Stokes Raman scattering imaging with principal component analysis to rapidly map lipophilic components in cardiovascular tissues, facilitating the interrogation of atherosclerosis.

NMC • Nonlinear I–Continued

OMC • Clinical/Pre-clinical Applications I–Continued

OTMC • Analysis of Biological Systems–Contributed

OMC3 • 14.00
Optical Monitoring of Tracers and Mitoxantrone in Rabbit Brain and the Variability in Blood-Brain Barrier Disruption, Aysegul Ergin1, Mei Wang2, Shailendra Joshi2, Irving J. Bigio1; 1Department of Biomedical Engineering, Boston Univ., USA; 2Dept. of Anesthesiology, College of Physicians and Surgeons of Columbia Univ., USA. Intraarterial mannitol is the main method to disrupt blood-brain barrier. The data collected using optical pharmacokinetics revealed variation in disruption in rabbits. Optical monitoring could help better understand the drug pharmacokinetics.

OMC4 • 14.15
Time-Resolved Fluorescence Spectroscopy of the Bile Duct for Image-Guided Cancer Diagnosis, Javier A. Jo1, Javier A. Jo2, Matthew W. Miller1, Eric J. Seibel1; 1Biomedical Engineering, Texas A&M Univ., USA; 2Veterinary Medicine, Texas A&M Univ., USA; 3Mechanical Engineering, Univ. of Washington, USA. An ultra thin (1.2-1.6 mm diameter) scanning fiber endoscope, capable of video-rate high-resolution imaging of the bile duct, will be used as a “guidewire-with-eyes” to guide time-resolved fluorescence spectroscopy of the duct for cancer diagnosis.

NMC • Nonlinear I–Continued

OMC1 • 14.30
Invited
Title to be Announced, Stanislav Emelianov; Univ. of Texas at Austin, USA. Abstract not available.

OMC4 • 14.30
Invited
Title to be Announced, Pietro Cicuta; Cambridge Univ., UK. Abstract not available.

OTMC • Analysis of Biological Systems–Contributed
**BMC5 • 14.45**

Mode Splitting in Whispering-Gallery-Mode Microresonators in Aquatic Environment, Woosang Kim1, Sahin K. Ozenmen1, Jiangang Zhao1, Lina He1, Lan Yang1; 2Electrical Engineering, Washington Univ., St.Louis, USA. We demonstrate scatterer-induced mode splitting in Whispering-Gallery-Mode resonators as a new sensing scheme in water. It is used to achieve detecting polystyrene particles of radii 50nm with a similar size as influenza A virus.

**BMC6 • 15.00**

Study of the Dynamics of Protein Aggregation with a Bloch Surface Wave Sensor, Vincent Paeder1, Valeria Musi2, Hans Peter Herzog2; 1EPFL, Switzerland. We present a study of the dynamics of protein aggregation using an interferometric Bloch surface wave sensing scheme. We demonstrate the ability to detect, during thermal incubation, the aggregation of proteins related to conformational diseases.

**BMC7 • 15.15**

Screening Small Molecule Compounds for Protein Ligands with Label-Free, Optically Detected Microarrays, Xiangdong Zhu1; 1Physics, Univ. of California at Davis, USA. We developed an optical scanner for label-free screening small molecule compounds in microarray format for protein ligands. It has a detection throughput of 12,000 compounds per slide and thus promises screening 100,000 compounds daily.

**NMC5 • 15.00**

Remote Focusing Differential Multiphoton Microscopy: Application to Neuronal Imaging, Erich E. Hoover1, Michael D. Young1, Suay M. Kim2, Eric V. Chandler3, Jeffrey J. Field3, Daun N. Vitkó1, Kragi E. Sheetz2, Jing W. Wang3, Jeff A. Squier4; 1Physics, Colorado School of Mines, USA; 2Biological Sciences, Univ. of California at San Diego, USA; 3Physics and Nuclear Engineering, United States Military Academy, USA. We apply remote focusing to multi-focal multiphoton microscopy by simultaneously imaging multiple focal planes of Drosophila melanogaster olfactory neurons. This technology permits imaging the entire volume of the antennal lobe in a single scan.

**NMC6 • 15.15**

Laser Microsurgery for Two-Photon Imaging in Fruit Flies, Supriyo Sinha1, Liang Li2, Eric Ho3, Liqun Luo2, Tom Baer4, Mark Schnitzer5; 1Stanford Univ., USA; 2Howard Hughes Medical Inst., USA. We demonstrate precise, minimally invasive, laser microsurgery of the fruit fly cuticle for in vivo brain imaging. Following surgery, flies behave normally, as determined by their phototaxis. We recorded odor-evoked calcium transients with 60.

**NMC7 • 15.15**

Screening Small Molecule Compounds for Protein Ligands with Label-Free, Optically Detected Microarrays, Xiangdong Zhu1; 1Physics, Univ. of California at Davis, USA. We developed an optical scanner for label-free screening small molecule compounds in microarray format for protein ligands. It has a detection throughput of 12,000 compounds per slide and thus promises screening 100,000 compounds daily.

**OMC2 • 15.00**

Translational Advances in Reflectance Confocal Microscopy of Skin Cancer: Machine Learning-Based Image Classification, and Tumor Mapping in Shave Biopsy Wounds, Milind Rajadhyaksha; Dermatology Service, Memorial Sloan-Kettering Cancer Ctr., USA. Translational advances in reflectance confocal microscopy of skin cancers include automated methods to localize the dermo-epidermal junction, and imaging of residual tumor with a contrast agent in shave biopsy wounds toward intra-operative mapping.

**OMC5 • 15.00**

The Electrostatic Corral: Trapping Single DNA Molecules in Solution, Jorg C. Wehl, Christine A. Carlson; Chemistry and Biochemistry, Univ. of Wisconsin-Milwaukee, USA. In this contribution, we will discuss a novel and elegant approach for the trapping and manipulation of single biomolecules and other particles over extended periods of time free in solution: the electrostatic corral.

**OTMC5 • 15.00**

Concentration-Independent Modulation of Local Micromechanics in a Fibrin Clot, Elliot L. Botvinick1; 1Beckman Laser Inst., Univ. California Irvine, USA; 2Dept. of Biomedical Engineering, Univ. of California at Irvine, USA. Optical tweezers active microrheology (AMR) probes microdomain mechanical properties in 3-D engineered tissues. The application of a nonuniform strain field setups up distributed stiffness, measured by AMR, which yields differential cell phenotypes.
| Big Sur Room  
Bio-Optics: Design and Application (BODA) | Regency 1 & 2  
Novel Techniques in Microscopy (NTM) | Regency 3  
Optical Molecular Probes, Imaging and Drug Delivery (OMP) | Cypress Room  
Optical Trapping Applications (OTA) |
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<td><strong>BMD • Optical Biosensors II</strong></td>
<td><strong>NMD • Nonlinear II</strong></td>
<td><strong>OMD • Novel Probes II</strong></td>
<td><strong>OTMD • Trapping with Shaped Beams</strong></td>
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<td><strong>BMD1 • 16.00</strong></td>
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<td>Title to be Announced, Lan Yang;</td>
<td>In situ Measurement of Sarcomere Length in Cardiac Myocytes Using a Two-Photon Microscope with Near-Isotropic Scan Rate, Alex D. Corbetti, Gil Bab, Tony Wilson; Engineering Science, Univ. of Oxford, UK; 1Physiology, Anatomy and Genetics, Univ. of Oxford, UK. Images are presented showing sarcocere spacing within a living rodent heart. To uniquely identify the sarcocere spacing, two 2-D sections, angularly offset from each other, were sampled at high frame rate.</td>
<td>Luminescent Nanodiamonds for Intracellular Imaging, Andriy V. Zryagin1, Varun S. Sreenivasan2, Timothy A. Keff, Sergey M. Deger; 1Physics and Astronomy, Macquarie Univ., Australia; 2Shemyakin and Ovchinnikov Inst. of Bio-organic Chemistry, Russian Federation. Advances in production of single-digit luminescent nanodiamonds are reported. We report a versatile biocojugation protocol to dock biomolecules on the colloidal diamond leading to demonstration of non-specific and specific internalisations in cells.</td>
<td>Micro- and Nanoparticle Optical Trapping Using Cylindrical Vector Beams, Phil Jones1, Susan Skelton1, Marius Sergules1, Agata Pawlikowska1, Onofrio Marago2; 1Physics and Astronomy, Univ. of College London, UK; 2Natl. Physical Lab., UK; 1CNR-Inst. per i Processi Chimico-Feisici, Italy. We report on the optical trapping of a number of micro- and nanoparticles using beams with a non-uniform state of polarization and how geometry of the trap can be shaped by the polarization state.</td>
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<td><strong>BMD2 • 16.30</strong></td>
<td><strong>NMD2 • 16.15</strong></td>
<td><strong>OMD2 • 16.30</strong></td>
<td><strong>OTMD2 • 16.30</strong></td>
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<td>Continuous Oxygen Measurements in Bio-media Using Metal-Halide Cluster Phosphorescence, Ruby Ghosh, Reza Laloee; Physics, Michigan State Univ., USA. A dissolved oxygen sensor for biological media using the 30s quenching of the phosphorescence from MoCl clusters is presented. Real-time measurements for four hours over a physiologically relevant PO2 range show no evidence of photobleaching.</td>
<td>Nonlinear Optical Imaging with Sub-8fs Laser Pulses, Dmitry Pestov1, Bingwei Xu1, Huaowen Li2, Marcus Dantus3; 1Biophotonic Solutions Inc, USA; 2Chemistry, Michigan State Univ., USA. Broadband Ti:Sapphire oscillator output, guided through a pulse shaper, is compressed down to sub-8fs at the focus of a high-NA microscope objective. The compression is verified in situ by interferometric autocorrelation, and images were obtained.</td>
<td>Ultrasound-Quenchable Fluorescent Contrast Agent: Experimental Demonstration, Michael J. Benchimol1, Mark J. Hu2, Carolyn E. Schmitt1, Sadik C. Esener1; Jacoby School of Engineering, Univ. of California at San Diego, USA; 2Ziva Corp., USA. We have developed a novel contrast agent for deep tissue imaging. Ultrasound control of fluorescence emission can overcome the resolution limitations of optical tissue scattering. Fluorescence modulation was detected in an acousto-fluorescence setup.</td>
<td>Engineered Point Spread Functions for 3-D Parallel Particle Tracking of Optically Trapped Particles, Donald B. Conkey1, Rahul P. Trivedi2, Prassanna Pavani1, Ivan I. Smalyukh2, Rafael Piestun3; 1Electrical and Computer Engineering, Univ. of Colorado at Boulder, USA; 2Physics, Univ. of Colorado at Boulder, USA. We integrate a holographic optical tweezer system with a double-helix point spread function imaging for high precision three-dimensional (3-D) multi-particle tracking. We perform precise quantitative estimates of the 3-D forces in an optical trap.</td>
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<td><strong>NMD3 • 16.30</strong></td>
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<td>Nonlinear Phase Contrast Imaging in Neuronal Tissue, Prathyush Samaranayake1, Martin Fischer1, Henry C. Liu1, Ryohei Yasuda2, Warren S. Warren1; 1Chemistry, Duke Univ., Durham, USA; 2Neurobiology, Duke Univ., USA; 3Chemistry, Radiology and Biomedical Engineering, Duke Univ., USA. We demonstrate nonlinear phase contrast imaging in highly scattering media using rapid femtosecond pulse shaping of mode-locked laser pulses. We will also discuss potential applications of this technique for intrinsic functional neuronal imaging.</td>
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BMD3 • 16.45
A Novel Monte Carlo Approach for Diagnostic Fiber Optic Probe Design, Adam R. Gardner1,2, Carole Hayakawa1, Jerome Spanier7, Vasav Venugopalan1,2; 1Chemical Engineering and Materials Science, Univ. of California at Irvine, USA; 2Laser Microbeam and Medical Program, Beckman Laser Inst., Univ. of California at Irvine, USA. A radiative transport method based on efficient coupled forward-adjoint Monte Carlo simulations is used for the analysis of diagnostic fiber optic probes. Results are shown for various probe geometries within a layered tissue model.

NMD4 • 16.45
Beyond Pathology: Pump-Probe Imaging of Skin Slices Provides Additional Indicators of Melanoma, Mary Jane Simpson1, Thomas Matthews1, Angela Selim2, Ivan Piletic2, Warren S. Warren1; 1Chemistry, Duke Univ., USA; 2Pathology, Duke Univ. Medical Center, USA. Principal component analysis of images taken with a pump-probe scanning microscope resolves eumelanin and pheomelanin. Utilizing intrinsic melanin contrast in skin slices has revealed significant differences between melanoma and other lesions.

OMD3 • 16.45
Folate Receptor-targeted Aggregation-enhanced Emission Silica Nanoprobe for One-photon in vivo and Two-photon ex vivo Fluorescence Bioimaging, Xuhua Wang1, Alma R. Morales1, Takeo Urakami, Masanobu Komatsu5, Kevin D. Belfield1; 1Dept. of Chemistry, Univ. of Central Florida, USA; 2Sanford-Burnham Inst. for Medical Res. at Lake Nona, USA. A two-photon absorbing, aggregation-enhanced near infrared emission and folic acid conjugated silica nanoprobe was investigated for FRs targeting one-photon in vivo imaging and two-photon ex vivo imaging by employing nude mice bearing HeLa tumors.

OTMD3 • 16.45
Mapping of the Optical Field of a Focused Cylindrical Vector Beam by Trapped Rayleigh Particles, Liangcheng Zhou1, Qwen Zhang1, Daniel Ou-Yang1; 1Physics, Lehigh Univ., USA; 2Electro-Optics Graduate Program, Univ. of Dayton, USA. We propose a non-invasive method of mapping the optical field of a tightly focused laser beam by imaging transiently trapped nanoparticles. Optical field intensities are calculated from known trapping energy of the probe particles.

NMD5 • 17.00
Development of Multi-Photon Coherence Domain Molecular Imaging, Brian E. Applegate1, Qiujie Wan2, Nilanthi Warnasooriya3; 1Biomedical Engineering, Texas A&M Univ., USA. We have recently developed a high-resolution molecular imaging technique by fusing pump-probe spectroscopy and optical coherence microscopy. Basic concepts and progress toward improving imaging speed and spectral resolution will be discussed.

OMD4 • 17.00
Two-photon Absorbing Fluorene Derivatives with Efficient Stimulated Emission Depletion (STED) for Bioimaging, Kevin D. Belfield1, Mykhailo V. Bondar2,3, Alma R. Morales1, Olga V. Przhonska1, Xuhua Wang1; 1Inst. of Physics, Ukraine; 2Dept. of Chemistry, Univ. of Central Florida, USA. Stimulated emission depletion (STED) is emerging as an important photophysical process for superresolution microscopy. We report a new STED probe, its photophysical characterization, and potential use in bioimaging.

NMD6 • 17.15
Multiphoton Photothermal Imaging in Scattering Samples, Michael Durst4, Jerome Mertz5; 4Dept. of BME, Boston Univ., USA. We present multiphoton photothermal imaging of non-fluorescent, absorbing structures in scattering samples. Wide-field LED probe illumination is collected and de-scanned through a confocal pinhole. Nanoparticle and brain-slice imaging are presented.

OMD5 • 17.15
Near-Infrared Emitting Squaraine Dyes for Multiphoton Fluorescence Imaging with High 2PA Cross Sections, Hye-Yang Ahn1, Sheng Yao4, Xuhua Wang1, Kevin D. Belfield4; 1Chemistry, Univ. of Central Florida, USA. New near-infrared squaraine probe SQX (1), and squaraine dye, SQ440H (2), were investigated for their photochemical properties and cytotoxicity. In vitro one-photon and two-photon fluorescence microscopy imaging was demonstrated.
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<td>Cypress Room</td>
<td>Optical Trapping Applications (OTA)</td>
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**BMD • Optical Biosensors II–Contributed**

**NMD • Nonlinear II–Contributed**

**OMD • Novel Probes II–Contributed**

**OTMD • Trapping with Shaped Beams–Contributed**

**BTuC5 • 17.30** Invited
Intrinsic Optical Signal Imaging of Stimulus-Evoked Neural Activities in the Retina, Xincheng Yao, Yangguo Li, Yichao Li, Qixiang Zhang; Univ. of Alabama at Birmingham, USA. Intrinsic optical signal (IOS) imaging and electrophysiological recording were used to detect retinal neural activities. IOS imaging allowed dynamic monitoring of visual signal propagation from the photoreceptor to inner retinal neurons.

**NMD7 • 17.30**
Temperature Distribution in Red Blood Cells Using Photothermal Imaging Integrated with Digital Holography, George Chen, Srivathsan Vasudevan, Beng Koon Ng; BC Photonics Technological Co, Canada; School of EEE, Nanyang Technological Univ., Singapore. Integration of digital holographic microscope with photothermal microscope is proposed. Besides obtaining 3-D images, temperature distribution of red blood cells can be obtained, aiding real-time monitoring of biological assays.

**OTMD5 • 17.30**
Polarization Dependent Forces in Optical Vortex Pipeline, Niko Eckerskorn, Wieslaw Krolikowski, Vladlen Shvedov, Andrei Rode; Australian Natl. Univ., Australia. We study both, theoretically and in experiments, the dependence of optical forces acting on a spherical particle guided in air with an optical vortex beam, on the light polarization state, and discuss potential applications.

**OTMD6 • 17.45**
Loading Aerosol Optical Traps using Surface Acoustic Wave Devices, David McGloin, Suman Anand, Jonathan Nylk, Calvin Dodds, Steve L. Neale; Jonathan Cooper; Electronic Engineering and Physics, Univ. of Dundee, UK; Dept. of Electronics, Univ. of Glasgow, UK. We make use of surface acoustic wave nebulization to introduce airborne particles into optical traps in a robust and repeatable manner. We demonstrate the facile loading of aerosols such as organic liquids and solid particles.

**19.00–Welcome Reception, Spyglass Promenade**

**NOTES**
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<td>Big Sur Room</td>
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<td>Tuesday</td>
<td>8.00–10.00</td>
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<td>Novel Techniques in Microscopy (NTM)</td>
<td>Tuesday</td>
<td>8.00–10.00</td>
<td>Eric Potma; Univ. of California at Irvine, USA, Presider</td>
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<td>Regency 3</td>
<td>Optical Molecular Probes, Imaging and Drug Delivery (OMP)</td>
<td>Tuesday</td>
<td>8.00–10.00</td>
<td>Milind Rajadhyaksha; Memorial Sloan Kettering Cancer Ctr., USA, Presider</td>
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<td>Cypress Room</td>
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<td>Tuesday</td>
<td>8.00–10.00</td>
<td>Steve Neale, Univ. Glasgow, UK, Presider</td>
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**BTuA • Bio-Inspired Optics**

- **BTuA1 • 8.00** Invited Medical Imaging Systems Using Bio-Inspired Fluidic Lenses, Yuhua Lo; Frank Tsai, Aashkan Arianpour; ECE, Univ. of California at San Diego, USA. We discuss fluidic lens imaging systems for minimally invasive and image-guided cancer surgery. The system offers many unique capabilities such as optical zoom, macro and microscopic functions, high sensitivity, hyper spectral imaging, etc.

- **BTuA2 • 8.30** Invited Title to be Announced, Tony Wilson; Univ. of Oxford; UK. Abstract not available.

**NTuA • Imaging Through Tissue**

- **NTuA1 • 8.00** Invited Optical Methods for Imaging of Cerebral Hemodynamics, Andrew Dunn, Univ. of Texas at Austin, USA. Abstract not available.

- **NTuA2 • 8.30** Invited Towards Deep Tissue Imaging By Time-Reversal Optical Phase Conjugation Techniques, Changhui Yang; California Inst. of Technology, USA. Towards deep tissue imaging by time-reversal optical phase conjugation techniques.

**OTuA • Advances in Instrumentation or Algorithms II**

- **OTuA1 • 8.00** Invited Title to Be Announced, Vasilis Ntziachristos; Germany. Abstract not available.

- **OTuA2 • 8.30** Invited Fluorescence Lifetime Imaging for Cell Biology, Drug Discovery and Label-Free Diagnosis, Paul French; 1Physics, Imperial College London, UK. I will present FLIM technology to read out biomolecular interactions across the scales from labeled proteins in solution and in cells through automated plate readers to imaging disease models and endoscopic diagnosis using autofluorescence.

**OTTuA • Trapping Techniques and Applications I**

- **OTTuA1 • 8.00** Invited Optical Sculpting: Trapping through Disorder, Kishan Dalal; USA. Abstract not available.

- **OTTuA2 • 8.30** Improving Spot Uniformity in Holographic Optical Tweezers, Martin Persson1, David Engström1, Jörgen Bengtsson1, Mattias Gokoor4; 1Physics, Univ. of Gothenburg, Sweden; 2Microtechnology and Nanoscience, Chalmers Univ. of Technology, Sweden. We have developed a method for compensating for crosstalk between adjacent pixels in liquid crystal based spatial light modulators. The method decreases the uniformity error of the trap intensities in holographic optical tweezers (HOT) systems.

**OTTuA3 • 8.45** Integrated Instrument for Holographic Optical Trapping and Multicolor Holographic Video Microscopy, Bhaskar Jöoz Krishnatreya1, David G. Grier; 1Dept. of Physics and Ctr. for Soft Matter Res., New York Univ., USA. We designed and constructed an integrated holographic materials characterization and processing workstation that combines dynamical holographic optical trapping and multicolor holographic video microscopy with enhanced efficiency and adaptability.
Design of a Parallel 3-D Confocal Imaging System with Adaptive Objective Lens, Guangqi Li, Xiao Fang, Dongxue Zhu; Univ. of Missouri at St. Louis, USA. A nontranslational 3-D confocal imaging system using an adaptive objective lens for depth scanning over a 1mm range and a MEMS mirror array for parallel transverse sampling has been designed with a 2um transverse resolution.

Optomechanical Fluid-Filled Model of the Human Eye, Ashkan Arianpour, Eric Tremblay, Joseph Ford, Yuhua Lo; Univ. of California San Diego, USA. The following describes the design and performance of an optomechanical fluid-filled eye model and its use for testing flaws in an actual eye using optical components that can be modified to match an individual’s eye.

Revisiting the Stiles-Crawford Effect in Retinal Imaging, Brian Voeten; School of Physics, Univ. College Dublin, Ireland. Efficient photoreceptor light coupling benefits both vision and high-resolution retinal imaging. Here, the related Stiles-Crawford effect is analyzed in relation to scanning retinal imaging and the situation of a coherent fiber-bundle retina model.

An MR compatible Frequency Domain Fluorescence Molecular Imaging System: Design and Phantom Studies, Yuting Lin’, Michael Ghijsen’, Hao Gao1, Orhan Nalcioglu1, Guldes Gulsen1; ’Ctr. for Functional Onco Imaging, Univ. of California at Irvine, USA; 1Applied Mathematics, Univ. of California at Los Angeles, USA. In this study, a hybrid MR-frequency domain fluorescence tomography (FT) is developed. The phantom studies show that the anatomical images from MRI improve reconstruction of both fluorescence concentration and lifetime parameters significantly.

Sub-Micron Patterning of Rough Surfaces Using Optical Trap Assisted Nanopatterning, Remaon Fardel1, Yu-Cheng Tsai1, Craig B. Arnold1; ’Mechanical and Aerospace Engineering, Princeton Univ., USA. Optical trap assisted nanopatterning is used to write sub-micron features on substrates with pre-existing topography. Uniform patterns are successfully written across a large-scale trench on a polyimide surface.
Genetic Algorithm Optimization of Phase Masks for Focusing Light through Turbid Media, Donald B. Conkey, Albert Brown, Antonio Caravaca, Rafael Piestun; Electrical and Computer Engineering, Univ. of Colorado at Boulder, USA. We introduce genetic algorithms for wave-front control to focus light through scattering media. Genetic algorithms are attractive, because of their parallelism and global optimization properties.

Two-Dimensional Surface Plasmon Resonance (SPR) Biosensor based on Infrared Imaging, Chi Lok Wong1, George Chew1, Benny Koon Ng2; 1BC Photonics Technological Co., Canada; 2School of EEE, Nanyang Technological Univ., Singapore. A surface plasmon resonance imaging biosensor based on IR imaging is demonstrated. A sensor resolution of 9.4 x 10-6 RIU is achieved which is better than reported by conventional intensity based SPR imaging sensors.

Optical Manipulation in the Evanescent Field of a Nanofiber via Spatial Light Modulation, Mary Frawley1,2, Alex Petcu-Colan1,2, Sile Nic Chormaic1,2; 1Physics Dept., Univ. College Cork, Ireland; 2Photonics Ctr., Tyndall National Inst., Ireland. We propose to selectively generate higher order mode superposition in an optical nanofiber. By adiabatically coupling Gaussian and SLM-generated Laguerre-Gaussian beams into the fiber, trapping sites form in the evanescent field at the fiber waist.
<table>
<thead>
<tr>
<th>Big Sur Room</th>
<th>Regency 1 &amp; 2</th>
<th>Regency 3</th>
<th>Cypress Room</th>
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<tbody>
<tr>
<td><strong>Bio-Optics: Design and Application (BODA)</strong></td>
<td><strong>Novel Techniques in Microscopy (NTM)</strong></td>
<td><strong>Optical Molecular Probes, Imaging and Drug Delivery (OMP)</strong></td>
<td><strong>Optical Trapping Applications (OTA)</strong></td>
</tr>
</tbody>
</table>

### BTuB • Visual Optics

**Tuesday, 5 April**  
10.30–12.30  
**Presider to Be Announced**

#### BTuB1 • 10.30 invited

**Optical Engineering for Intra-Ocular Lens (IOL) Selection and Customization**, Chris Dainty1, Alexander Gencharov2, Diana Bogushevich2, Patrick Collins1, Arthur Cummings1, Huanqing Gao3, Eugene Ng3, Anton Sharapov3, Matt Sheehan3, Kevin Smith3; 1School of Physics, Nat’l. Univ. of Ireland Galway, Ireland; 2‘Nat’l. Digital Res. Ctr., Ireland; 3‘ClearSight Ltd, Ireland. We describe new methodologies for the selection of the most appropriate power of intra-ocular lens (IOL) in cataract surgery, and how one might develop customized solutions for IOLs.

#### BTuB2 • 11.00 invited

**Title to Be Announced**, Christian Sandstedt; Callioun Vision, Inc., USA. Abstract not available.

#### NTuB • Phase I

**Tuesday, 5 April**  
10.30–12.30  
**Randy Bartels, Colorado State Univ., USA, Presider**

#### NTuB1 • 10.30 invited

Random and Deterministic Transport in Live Cells Quantified by SLIM, Gabriel Popescu1; 1Electrical and Computer Engineering, Univ. of Illinois at Urbana-Champaign, USA. We used quantitative phase imaging to measure the dispersion relation, i.e. decay rate vs. spatial mode, gamma(ω), associated with mass transport in live cells.

#### NTuB2 • 11.00 invited

**Tomographic Reconstruction by Quantitative Phase Imaging with Broadband Fields**, Zhuo Wang, Daniel Marks, Scott Carney, Mustafa Mir, Gabriel Popescu; Electrical and Computer Engineering, Univ. of Illinois at Urbana-Champaign, USA. We developed a theoretical and experimental approach that allows for solving the 3D scattering inverse problem via quantitative phase imaging with broadband fields.

### OTuB • Clinical/Pre-clinical Applications I

**Tuesday, 5 April**  
10.30–12.30  
**Paul French, Imperial College London, UK, Presider**

#### OTuB1 • 10.30 invited

Optical Techniques for Tracking Cells in vivo, Charles P. Lin; Wellman Ctr. for Photomed, Harvard Med School, Massachusetts General Hospital, USA. I will focus on tracking cancer cells, immune cells, and stem cells in vivo using (i) intravital microscopy for 3-D tissue imaging, and (ii) in vivo flow cytometry for detection and quantification of circulating cells.

### OTuB • Trapping Techniques and Applications II

**Tuesday, 5 April**  
10.30–12.30  
**Daniel Burnham, Univ. of Washington, USA, Presider**

#### OTuB2 • 11.00 invited

**Fiber-Based Dual-Beam Optical Trapping System for Studying Lipid Vesicle Mechanics**, Tessa M. Pinon1, Linda S. Hirst2, Jay E. Sharpe3; 1School of Engineering, Univ. of California at Merced, USA; 2School of Natural Sciences, Univ. of California at Merced, USA. We describe the mechanics of giant unilamellar vesicles (GUVs) which are manipulated using a fiber-based dual-beam optical trap. We prepare GUVs encapsulating various concentrations and molecular weights of poly(ethylene glycol) (PEG) polymer.

#### OTuB3 • 11.15 invited

**Microfluidic Particle Manipulation on Electro-Optic Surfaces**, Michael Essling, Stefan Glaesener, Cornelia Denz; Inst. of Applied Physics, Germany. We present all-optical method for the creation of large-scale particle arrays on the surface of electro-optic crystals. Manipulation of matter is achieved by dielectrophoretic forces exhibited by the strong internal fields of these materials.

Optics in the Life Sciences Congress and Exhibition • 4–6 April, 2011
Bio-Inspired Structural Olor Waveplates and Polarizers and their Applications, Stanley Pau, Graham Myhre, Arshad Sayyad; College of Optical Sciences, Univ. of Arizona, USA. By studying the polarization property of jeweled beetles, we develop novel optical coatings that can be patterned at high spatial resolution and have precise optical retardance and polarization dependent absorption.

Spectral-domain Differential Interference Contrast Microscopy, Yizheng Zhu, Nathan T. Shaked, Lisa Satterwhite, Adam Wax; Dept. of Biomedical Engineering, Duke Univ., USA. We present a novel imaging technique, termed spectral-domain DIC microscopy, for high-resolution quantitative measurement of optical pathlength gradients. Imaging of resolution target and live cardiomyocytes were demonstrated with 36pm resolution.

4-Dimensional Microscope System for Dynamic Phase Imaging, Katherine Creath; 4-D Technology Corp. and Univ. of Arizona, USA. New, novel interference microscope system utilizing a pixealted phase sensor capturing dynamic phase images in vitro, enabling volumetric, motion and morphological studies, including examples of monitoring different biological processes and motions.

Fluorescence Diffuse Optical Tomography with Multiple View Structured Illumination, Nicolas Ducros1, Andrea Bassi1, Gianluca Valentini1, Martin Schweiger2, Simon Arridge2, Cosimo D’Andrea3; 1Physics, IFN-CNR, IIT, Dept. di Fisica, Italy; 2Dept. of Computer Science, Univ. College London, Italy. Fluorescence Diffuse Optical Tomography with structured light is demonstrated using multiple views. Reconstructions from simulated and experimental data sets is carried out. Multiple view approach improves the spatial resolution of reconstruction.

4-Dimensional Microscope System for Intravaginal Microbiccidr Gel Coating Thickness Distribution, Tyler K. Drake, Jennifer Peters, Marcus Henderson, Michael DeSoto, David Katz, Adam Wax; Biomedical Engineering, Duke Univ., USA. A clinical optical probe incorporating simultaneous fluorescence and low coherence interferometry imaging was developed. A clinical study was performed to compare fluorimetry and LCI in measuring intravaginal microbiccidr gel thickness distribution.

Spectral-domain Differential Interference Contrast Microscopy, Yizheng Zhu, Nathan T. Shaked, Lisa Satterwhite, Adam Wax; Dept. of Biomedical Engineering, Duke Univ., USA. We present a novel imaging technique, termed spectral-domain DIC microscopy, for high-resolution quantitative measurement of optical pathlength gradients. Imaging of resolution target and live cardiomyocytes were demonstrated with 36pm resolution.
### Big Sur Room
Bio-Optics: Design and Application (BODA)

### Regency 1 & 2
Novel Techniques in Microscopy (NTM)

### Regency 3
Optical Molecular Probes, Imaging and Drug Delivery (OMP)

### Cypress Room
Optical Trapping Applications (OTA)

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### NTuB • Phase I–Continued

**NTuB7 • 12.15**

X-ray Photon Sieves for Phase-contrast Microscopy, Guanxiao Cheng1,2, Chao Hu1,2, Max Q.-H. Meng2,3; 1Shenzhen Inst. of Advanced Technology, Chinese Academy of Sciences, China; 2Chinese Univ. of Hong Kong, China. A diffractive compound objective integrated the Zernike phase shift in an apodized photon sieve (ZAPS) is presented for high-resolution X-ray phase-contrast microscopy. The focusing properties of the ZAPS can be easily adjusted by pupil apodization.

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### OTuB • Clinical/Pre-clinical Applications II–Continued

**OTuB6 • 12.15**

Rapid Confocal Imaging of Large Area Excised Tissue with Strip Mosaicing, Sanjee Abeytunge1, Yongbiao Li1, Bjorg A. Larson1, Ricardo Toledo-Crow1, Milind Rajadhyaksha1; 1Res. Engineering Lab., Memorial Sloan Kettering Cancer Ctr., USA. Strip mosaicing in a confocal microscope allows imaging of cellular morphology over large-area tissue for rapid pathology at the bedside. We scan 10 mm long strips and stitch to display 100 mm2 in five minutes.

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### OTTuB • Trapping Techniques and Applications II–Continued

**OTTuB6 • 12.15**

Message In a Bottle the Statistical Behavior of Nanoparticles in Optical Confinement, Liangcheng Zhou1, Daniel Ou-Yang1, Joseph Junio1, Jack Ng1, Joel Cohen1, Zhifang Lin4; 1Physics, Lehigh Univ., USA; 2Physics, Hong Kong Univ. of Science and Technology, Hong Kong; 3Physiology, Univ. of the Pacific, USA; 4Physics, Fudan Univ., China. A focused laser produced optical bottle transiently traps nanoparticles while 3-D fluorescence imaging maps the nanoparticle distribution.

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### 12.30 –13.30 Lunch Break (on your own)

NOTES
JTuA: Joint Poster Session, Regency Main
13.30–15.30

JTuA1
Customized Eye Modeling Using Clinical Pentacam and Wavescan Data, Ying-Ling A. Che1, Lei Shi2, Jim Lewis1, Ming Wang1, Ryan Vidal3; ‘Ctr. for Laser Applications, Univ. of Tennessee, USA; 2Wang Vision Inst., USA; 3E-Vision Technologies Inc., USA. We incorporated anterior chamber components, axial length, and wavefront measurements to construct pilot customized eye models for extensive applications. 2I normal and diseased eyes were successfully constructed with RMS 0.01 wave accuracy.

JTuA2
Determination of Resorption in Bone Using Phase Shifting Interferometry, George Cher1, Joachim Loo1; 1BC Photonics Technological Co, Canada; 2School of Materials Science and Engineering, Nanyang Technological Univ., Singapore. Phase Shifting Interferometer using the Carre and Hariharan algorithms is proposed for quantifying resorption in bone sample. Advantages of the system include being non-contact, 3-D profile, less time consuming, and relatively inexpensive.

JTuA3
Biophotonic Studies of Intracellular Responses to Nanosecond, Megavolt-per-meter, Pulsed Electric Field, Yu-Hsiuan Wu1, Stefania Romao2, Martin A. Gundersen1, P. Thomas Verner2; 1Chemical Engineering and Materials Science, Univ. of Southern California at Los Angeles, USA; 2Information Engineering, Second Univ. of Naples, Italy. 1Electrical Engineering, Univ. of Southern California at Los Angeles, USA; 2MOSIS/Information Sciences Inst., Univ. of Southern California at Marina Del Rey, USA. The effects of nanoelectropulses on intracellular structures are reported in this work. The real-time investigation is performed by means of a system consisting of a fluorescence microscope, an EMCCD camera and a photomultiplier tube.

JTuA4
Enhanced Bio-Sensing by Mechanically Stretching Active Plasmonic PDMS Device, Yanhui Zhao1, Ahmad A. Nawaz1, Tony J. Huang2; 1Engineering Science and Mechanics, Pennsylvania State Univ., USA. We demonstrated a bio-sensing tool involving deposition of gold coated PS nanospheres over a PDMS substrate. Sensing spectrum can be tuned by stretching PDMS substrate, providing large sensing range within a single structure.

JTuA5
Quantifying Kinetics and Dynamics of DNA Repair Proteins Using Raster-Scan Image Correlation Spectroscopy and Fluorescence Recovery after Photobleaching, Salim Abdilalam1; 1Bioengineering, Univ. of Texas at Arlington, USA. DNA double-strand breaks (DSBs) are one of the most lethal DNA damage occurs in mammalian cells. In this work, RICS and FRAP techniques are used to study kinetics of double strand break repair proteins before and after γ-irradiation in vivo.

JTuA6
Time-Gated Raman Spectra of Living Samples, Zachary Smith1, Florian Knorr1, Sebastian Wachsmann-Hogiu2; 1Ctr. for Biophotonics, Univ. of California at Davis, USA. We have developed an 800 fs all-optical gate capable of providing approximately 1.

JTuA7
Statistical Analysis of Biotissues Mueller Matrix Images in Cancer Diagnostics, Roman M. Tsykaliak1; 1Correlation Optics, Chernivtsi Natl. Univ., Ukraine. Application of lasers in biomedical optics caused the development of other research areas - biospeckles. This research was aimed at the potentialities of laser polarimetry in diagnostics of optically thick, multilayer tissues of human prostate.

JTuA8
Long Gradient Index Lens Multiphoton Endoscopic Systems, David Hucland1, Scott Howard1, Watt W. Webber, Chris Xu1; 1Biomedical Engineering, Cornell Univ., USA; 2Applied and Engineering Physics, Cornell Univ., USA. We characterize long (up to 285 mm) GRIN lens endoscope systems for multiphoton imaging use. Axial and lateral point spread functions are presented.

JTuA9
Label-Free Detection of Calcifications in the Breast, Zhuo Wang1, Kristinnao Tangello2, Gabriel Popescu2; 1Electrical and Computer Engineering, Univ. of Illinois at Urbana-Champaign, USA; 2Pathology, Univ. of Illinois at Urbana-Champaign, USA; 3Christic Clinic, USA. We demonstrated that phase shifts and refractive index changes measured via quantitative phase imaging can be an indicator for calcifications in breast tissue biopsies.

JTuA10
Live 3-D Imaging of HIV-1 Transfer through the Virological Synapse, Deanna L. Thompson1, Gregory McNerney2, Benjamin M. Dale3, Benjamin K. Cher1, Thomas Husser1; 1NSF Center for Biophotonics Science and Technology, Univ. of California at Davis, USA; 2Mount Sinai School of Medicine, USA. Live, 3-D, multicolor imaging of cell-to-cell HIV-1 transmission using spinning disk confocal microscopy and a replication-competent fluorescent clone of the virus reveals clues to HIV’s evasion of the human immune system.

JTuA11
Fast, Approximate Gaussian Mask Algorithm, Alexander R. Small1, Nahom Yirga2; 1Physics, California State Polytechnic Univ., USA. Gaussian Mask is an algorithm for localizing fluorophores in microscopy. Using simulated images, substantial speed improvements are shown to be possible if good initial position estimates are available and the fitting function is Taylor-expanded.

JTuA12
Tunable, Low Repetition Rate, Femtosecond Pulse Ti:Sapphire Laser for in vivo Imaging by Nonlinear Microscopy, Robert Szipoecs1, Peter Gyula Antal1, Attila Szolgay1, Attila Kolosics1; 1Laser Applications, Res. Inst. for Solid State Physics and Optics of the Hungarian Academy of Sciences, Hungary; 2R&D Ultrafast Lasers Ltd., Hungary. We report on a broadly tunable, long-cavity, low-pump-threshold, pulsed Ti:Sapphire laser. The laser delivers nearly transform limited ~300 fs, ~10 nJ pulses at 22 MHz repetition rate being ideal for nonlinear microscopy.
**JTuA13**
Early Glutamate-mediated Cell Death Detection with Digital Holographic Microscopy, Nicolai Pavlou1, Jonas Kühn2, Pascal Jourdain1, Christian D. Depeursinge1, Pierre J. Magistretti1, Pierre Maquet1; 1Microvision and Microdiagnostics Group, STI, Ecole Polytechnique Fédérale de Lausanne, Switzerland; 2Dépt. de Psychiatrie, CHUV, Prilly, Switzerland. We demonstrate the capability of digital holography to dynamically detect non-invasively cell death through the measurement of cellular volume regulation, considered as an early indicator of cellular deregulation, leading to cell death triggering.

**JTuA14**
In vivo Real Time FF-OCT of the Rat Brain, Jonas Binding1, Juliette Benarous2, Sylvain Gégan3, Claude Boccara1, Jean-François Léger1, Laurent Boudreau1; 1IBENS, ENS, Paris, France; 2Inst. Langevin, ESPCI ParisTech, Paris, France; 3Max Planck Inst. for Medical Res., Heidelberg, Germany. We demonstrate the ability of full-field OCT to image the cortex of living rats. The main feature that appears is individual myelin fibers. A precise measurement of the brain refractive index has also been obtained.

**JTuA15**
Extended Field of View Confocal Microscopy, Kristen C. Maitland1, Meagan Saldau2, Cory Oboswky3; 1Biomedical Engineering, Texas A&M Univ., USA. We exploit a fast motorized translation stage to replace the frame scan mirror in a raster scanning confocal microscope to extend field of view in one axis. 5cm x 1mm image is captured in <10 seconds.

**JTuA16**
Tip Enhanced Raman Spectroscopy (TERS) Instrumentation for Probing Linearized DNA for Cancer-Specific Lesions: Challenges and Outcomes, Noah Kołodziejski1, Rajan Gurjar1, David Wolfe1; 1Radiation Monitoring Devices, USA. We have adapted Tip-Enhanced Raman Spectroscopy (TERS) technology to a DNA sequencing modality simultaneously sensitive to a broad spectrum of cancer-relevant lesions. Obstacles encountered while approaching single-base resolution will be discussed.

**JTuA17**
Two-photon Absorbing Probes and Their Use in Two-Photon Fluorescence Microscopy of Cells and ex vivo Imaging of Tumors, Ciceron Yanez1, Carolina D. Andrade1, Alma R. Morales1, Takes Uratami2, Masanobu Kamatsu3, Kevin D. Belfield4; 1Chemistry, Univ. of Central Florida, USA; 2CREOL, Univ. of Central Florida, USA; 3Sanford-Barium Medical Research Inst., USA. Efficient two-photon (2PF) absorbing dyes and bioconjugates were used in two-photon fluorescence microscopy (2PFM) of cells, tissue sections, and excised tumors. Results show the utility of these dyes in studying biological processes.

**JTuA18**
Non-Invasive Staining of the Whole Astrocytic Network in the Rodent Brain through Systemic Administration of Sulforhodamine Dyes: Intravital and in vivo Applications, Florence Appaux1, Johannes Koenen1, Boudeijn van der Sanden2, Sabine Girard1, Sylvia Boisvieux1, Mireille Allieux1, Hartmut Wege3, Isabelle Guillaumin1, Antoine Depaule1, Jean-Claude A. Viol1; 1Laboratoire de Spectrométrie Physique, CNRS, Saint Martin d’Héres, France; 2Inst. des Neurosciences de Grenoble, INSERM, France. As compared to local injections of sulforhodamine-B and sulforhodamine-101, i.v. administration of these dyes was shown to be more efficient and less invasive for astrocyte staining in the whole rodent brain.

**JTuA19**
High-Speed Imaging of Microbubble Formation in a Novel Flow Focusing Microfluidics Chip, Paul Campbell; Physics, Univ. of Dundee, UK. This work aimed to produce monodisperse microbubbles for use as theranostic agents in medical ultrasound. We describe our design for a glass microfluidic chip with a distinctive flow focusing junction that ensure monodispersity.

**JTuA20**
Turbidity Measurements on Suspended Lipid Microbubble Populations Subjected to Ultrasound, Paul Campbell; Physics, Univ. of Dundee, UK. The turbidity of solutions containing 2 ultrasound contrast agents (SonoVue®.Bracco Diagnostics, Inc. and Sonazoid™, GE HealthCare) was measured as a function of ultrasound exposure, and correlations developed with their bioeffects in vitro.

**JTuA21**
Novel Two-Photon Fluorescence Probes for Zinc Ion Sensing, Andrew Frazer1, Xiahua Wang1, Doo M. Nguyen1, Alma R. Morales1, Kevin D. Belfield2; 1Chemistry, Univ. of Central Florida, USA. We report the synthesis, photophysical characteristics of two photon fluorescent (2PF) probes which shows superior specificity for zinc coupled with two photon microscopy imaging utilized to evaluate detection of Zn2+ in vivo.

**JTuA22**
Forward Problem Solution in Photoacoustic Tomography by Discontinuous Galerkin Method, Srijesta Bagchi1, Debasis Roy1, Ram Mohan Vasi1; 1Dept. of Instrumentation and Applied Physics, Indian Inst. of Science, India; 2Dept. of Civil Engineering, Indian Inst. of Science, India. This paper attempts to model the forward problem in photoacoustic tomography (PAT) using discontinuous Galerkin (DG) method. Numerical experiments show that DG solutions are comparable with those obtained by finite element method (FEM).

**JTuA23**
Please see OTTuC3

**JTuA24**
Evanescence Wave Optical Trapping Using Tapered Optical Fibers, Marias Serges1, Susan E. Shelton1, Radhika Patel1, Agata Pawelkowska1; 1Phil Jones1; 1Physics and Astronomy, Univ. College London, UK; 2Nat. Physical Lab., UK. We investigate experimentally and theoretically the trapping of micro- and nanoparticles in the evanescent field surrounding a tapered optical fiber and show how combinations of modes may be used to control trapped particle dynamics.
**JTuA • Joint Poster Session, Regency Main**

13.30–15.30

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**JTuA25**

**Plasmon-Enhanced Optical Trapping of Metal Nanoparticles**, Onofrio Marago1, Phil Jones2, Rosalba Saia3, Ferdinando Borghese1, Paolo Denti1, Maria A. Iati1, Pietro Gucciaridi1; 1CNR-Inist. per i Progetti Chimico-Fisici, Italy; 2CNR-Inist. per i Procesi Chimico-Fisici, Italy; 3Dip. di Fisica della Materia e Ing. Elettronica, Univ. di Messina, Italy. We investigate plasmon-enhanced trapping of metal nanoparticles. We calculate the optical forces on gold, silver and aluminium nanospheres through a procedure based on the Maxwell stress tensor in the transition T-matrix formalism.

**JTuA26**

**Radially Polarized Optical Tweezers**, Susan E. Skelton1, Marios Sergides1, Radhika Patel1, Agata Pawlikowska1, Onofrio Marago1, Phil Jones2; 1Dept. of Physics and Astronomy, Univ. College London, UK; 2Natl. Physical Lab, Teddington, Middlesex, UK; 3CNR-Inist. per i Procesti Chimico-Fisici, Italy. We present experimental measurements of the spring constants of a radially polarized optical tweezer for a wide range of micro- and nano-particles and compare the results to those obtained using linearly- and circularly-polarized trapping beams.

**JTuA27**

**Ultrafast Imaging of Microbubble Cavitation Using Integrated Optical Trapping for Spatial Control: Progress and Prospects**, Paul Campbell, Physics, Univ. of Dundee, UK. Cavitation science has experienced heightened interest within medical contexts due to the emerging theranostic capabilities of ultrasound driven microbubbles. We review the state of the art for optically controlled observations at MHz framing rates.

**JTuA28**

**NanoTracker Force-Sensing Optical Tweezers for Quantitative Single-Molecule Nanomanipulation**, Joost van Maren1, Helge Eggert1, Gerd Behne1, Claudia Rötter1; 1JPK Instruments AG, Berlin, Germany. JPK has developed an optical tweezers platform the NanoTracker This allows controlled trapping and accurate tracking of nanoparticles suspended either in a microfluidic multichannel flow chamber or even in temperature-controlled open Petri dish.

**JTuA29**

**Dark Spot Trapping Using a Double-Ring-Shaped Radially Polarized Beam**, Yuichi Kozawa1, Shunichi Satoh2; 1Inst. of Multidisciplinary Res. for Advanced Materials, Tohoku Univ., Japan. We experimentally demonstrated an optical trapping of opaque particles, which were captured in a dark spot created by tightly focusing of a double-ring-shaped, radially polarized beam (TM02 mode beam).

**JTuA30**

**Generation of Trapping Sites in the Evanescent Field of a Fiber Taper Coupler**, Mary Frawley1, Galvin Khara1, Sile Nic Chormaic1,2; 1Physics Dept., Univ. College Cork, Ireland; 2Photonics Centre, Tyndall Natl. Inst., Ireland. We propose to create optical trapping minima in the evanescent field of a fiber taper coupler by selectively exciting combinations of the HE11, TE01 and HE21 higher order modes in the waist region.

**JTuA31**

**Please see OTTuC2**

**JTuA32**

**Optical Binding in the Asymmetrical Configurations**, Vitezslav Karasek1, Otto Brzobohaty1, Pavel Zemanek1; 1Inst. of Scientific Instruments of the ASCR, Czech Republic. We study both experimentally and theoretically optical interactions called as optical binding between micro- and nanoscopic particles. We observed new and unexpected manifestations for particles asymmetrically placed in incident optical fields.

**JTuA33**

**An Approach to Selective Optical Isolation and Cloning of Cyanobacteria of Atacama Desert**, Gabriél Araneda1,2, Nataly Cisternas San Martin1,2, Juan Pablo Staforelli1,2; 1Dept. de Física, Univ. de Concepción, Chile; 2Ct. for Optics and Photonics, Chile. We propose a low-cost, highly precise and robust protocol for individual isolation of Cyanobacteria selected from a mixtures of species, combining optical tweezers techniques and flow control by gravity force.

**JTuA34**

**Vortical Optical Traps Based on Spiral Beams**, Kirill Afanasiev1, Alexander Korobtsov1, Svetlana Korotnova, Nikolay Losevsky1, Vsevolod Patlan, Eugenia Razueva1, Vladimir Volostnikov, Evgeny Vorontsov2; 1Inst. of Scientific Instruments of the ASCR, Czech Republic; 2LPI Samara Branch, Russian Federation. The possibility is shown to form vortical light fields with the desired intensity distribution by means of phase-only DOEs based on spiral beams optics. Experiments on fields generation with SLM and laser manipulation are presented.
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<tr>
<th>Session</th>
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<th>Abstract</th>
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<tr>
<td>BTuC1 • 16.00</td>
<td>High-Speed Nonlinear Harmonic Generation Holographic Microscopy, Randy Bartels(^1), Philip Schlipf, Jesse Wilson(^2); Electrical and Computer Engineering, Colorado State Univ., USA; (^1)School of Biomedical Engineering, Colorado State Univ., USA. We present three-dimensional images of biological samples using nonlinear optical, holographic microscopy. The oscillator operates at a wavelength with low scattering in the sample and its low average power prevents damage to the samples.</td>
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<tr>
<td>NTuC1 • 16.00</td>
<td>Holographic Second Harmonic Generation Microscopy, Etienne Shaffer(^1), Pierre Marquet(^1), Christian D. Depierreinge(^1); École Polytechnique Fédérale de Lausanne (EPFL), Switzerland; (^1)Dépt. de Psychiatrie-CHUV, Sûte de Cery, Switzerland. Holographic second harmonic generation (SHG) microscopy is a non-scanning imaging technique that retrieves both the amplitude and the phase of SHG. Here, we present an overview of the technique and its applications.</td>
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<tr>
<td>OTuC1 • 16.00</td>
<td>A New Optical Nano-Construct Composed of a Genome-Depleted Plant Virus Doped with a Near Infrared Organic Chromophore, Bongui Jung(^1), Ayula L. Rao(^2), Bahman Ansari(^1); Bioengineering, Univ. of California at Riverside, USA; (^1)Plant Pathology and Microbiology, Univ. of California at Riverside, USA. We have engineered an optical construct composed of the brome mosaic virus doped with indocyanine green, an FDA-approved chromophore. These constructs may offer a non-toxic platform for site-specific and deep tissue optical imaging and phototherapy.</td>
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<tr>
<td>OTuC2 • 16.30</td>
<td>Resolving Interparticle Position and Optical Forces along the Axial Direction Using Optical Coherence Gating, Woei Ming Lee(^1), Tzu Hao Chou(^2), Beng Koon Ng(^2); Wellman Photomedicine, Harvard Medical School and Massachusetts General Hospital, USA; (^1)School of Electrical and Electronic Engineering, Nanyang Technological Univ., Singapore; (^2)Singapore-MIT Alliance, Natl. Univ. of Singapore, Singapore; Center for Singapore-MIT Alliance, Singapore. We demonstrate the use of coherence gating to resolve particle positions and forces in the axial direction. High depth resolvability (micrometers) and weak optical force (femtonewton) measurements in an optical trapping system is achieved.</td>
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<td>Bio-Optics: Design and Application (BODA)</td>
<td>Novel Techniques in Microscopy (NTM)</td>
<td>Optical Molecular Probes, Imaging and Drug Delivery (OMP)</td>
<td>Optical Trapping Applications (OTA)</td>
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**BTuC • Biomedical Optical Imaging—Continued**

**NTuC • Phase II—Continued**

**OTuC • Novel Probes III—Continued**

**OTTuC • Trapping Techniques and Applications III—Continued**

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**BTuC3 • 16.45**

Automated 3-D Detection of Giardia Lamblia Cysts as an Assessment of Potential Drinking-Water Resources using DHM with Partially Coherent Source, Ahmed El Mallahi, Christophe Mineth, Frank Dubois, Catherine Youussoufsy, Aurélie Detavernier, Jingxing Ma, Michel Verbanck; 1Microgravity Research Center, Univ. libre de Bruxelles, Belgium; 2Dept. Water Pollution Control, Univ. libre de Bruxelles, Belgium. Digital holographic microscopy under partially coherent source allows to identify intracellular morphologic features of parasitic protozoan (oo)cysts. A new rationale for the unambiguous detection of Giardia lambia contamination risks is proposed.

**NTuC3 • 16.45**

Surface Contrast Microscopy, Yeusef Naziriadeh, Uli Lemmer; 1Martina Gerken; 1Integrated Systems and Photonics, Inst. of Electrical and Information Engineering, Germany; 2Light Technology Inst. and Center for Functional Nanostructures (CFN), Germany. We report a purely optical method for contrast enhancement of specimen on surfaces. This method utilizes a photonic crystal slab between two crossed polarization filters as the microscope slide.

**OTuC3 • 16.45**

Ex vivo Tumor Imaging with a VEGFR-2 Selective Two-Photon Absorbing (2PA) Bioconjugate, Carolina D. Andreadi, Cicero Yanez, Hyoung-Yang Ahn, Kevin D. Belfield, Takao Urakami, Masanobu Komatsu; 1Chemistry, Univ. of Central Florida, USA; 2Sanford-Burnham Medical Res. Inst. at Lake Nona, USA. Ex vivo imaging of tumors has been successfully achieved by using a two-photon absorbing (2PA) fluorescent bioconjugate that selectively binds the vascular endothelial growth factor receptor 2 (VEGFR-2).

**NTuC4 • 17.00**

Invited

Cataract Surgery with OCT-guided Femtosecond Laser, Daniel Palanker1, Georg Schuler2, Neil Friedman1, Dan Andersson2, William Culbertson3; 1Ophthalmology, Stanford Univ., USA; 2OptiMedica Corp., USA; 3Bascom Palmer Eye Inst., USA. About a third of people in the developed world will undergo cataract surgery in their lifetime. Currently, cataract surgery is a manual procedure highly dependent on the surgical skills and complicating factors. We developed and tested an image-guided laser system to improve the precision and reproducibility of cataract surgery.

**NTuC5 • 17.15**

Nonlinear Restoration of Diffused Images, Laura Waller1, Dmitry V. Dylov2, Jason W. Fleischer2; 1GE Global Res. Ctr., Niskayuna, USA; 2Electrical Engineering, Princeton Univ., USA. We develop a method to recover diffused and noise-hidden images by using spatial nonlinearity to seed instability. Optimal recovery depends on signal content, scattering statistics, and nonlinear coupling strength.

**OTuC4 • 17.00**

How to Enhance the Two-Photon Brightness of Fluorescent Proteins?, Mikhail Drobizhev, Nikolay Makarov, Shane Tillo, Thomas Hughes, Aleksander Rebane; 1Montana State Univ., Bozeman, USA. Fluorescent proteins (FPs) are widely used in 2-photon absorption (2PA) microscopy as genetically-targeted probes. We provide the guidelines for increasing their peak 2PA cross section by tuning (via mutations) local electric field inside protein.

**OTTuC3 • 17.00**

Invited

A Next Generation BioPhotonics Workstation, Jesper Glückstad, Dept. Photonics Engineering, Techn. Univ Denmark, DTU Fotonik, Denmark. We are developing a Next Generation BioPhotonics Workstation to be applied in research on regulated microbial cell growth including their underlying physiological mechanisms, in vivo characterization of cell constituents and manufacturing of nanostructures and meta-materials.

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Intrinsic Optical Signal Imaging of Stimulus-Evoked Neural Activities in the Retina, Xinchong Yao, Yangguo Li, Yichao Li, Quxiang Zhang, Univ. of Alabama at Birmingham, USA. Intrinsic optical signal (IOS) imaging and electrophysiological recording were used to detect retinal neural activities. IOS imaging allowed dynamic monitoring of visual signal propagation from the photoreceptor to inner retinal neurons.

Quantitative Phase from Defocus, Shan Shan Kou1,2, Colin J. R. Sheppard1, Nicolas Pavillon1, Pierre Marquet1, Christian D. Depeursinge1; 1STI, Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland; 2Bioengineering, Natl. Univ. of Singapore (NUS), Singapore; 3Dépt. de Psychiatrie DP-CHUV, Univ. de Lausanne Switzerland. We present a non-iterative technique that unlike solving the transport of intensity equation (TIE) obtains the quantitative phase of a weak object using only the inversion of an optical transfer function in defocused situation.

Complex Field imaging for Diffraction Tomography, Isabelle Bergond1, Cristian Arfie1, Yann Cotte1, Christian D. Depeursinge1; 1Microvision and Microdiagnostics Group, EPFL, Switzerland. We present a technique to recover 3-D refractive index distribution of cells using Digital Holographic Microscopy. Diffraction tomography is performed by two-axes rotation of the sample and aberrations corrected imaging with high numerical aperture.

Dynamic Biomolecule Sensing Bead Array Held by Optical Tweezers, Mad Manesese1,2, Christopher N. Lafratta1, Manuel A. Palacios3, Aaron F. Phillips1, David R. Walt1; 1Chemistry Dept., Tufts Univ., USA; 2Chemistry Dept., Bard College, USA. We have developed a platform using optical tweezers to create dynamic arrays of functionalized microbeads in microfluidic channels. The array is then exposed to analyte signaling molecules and washes, and interrogated using fluorescence microscopy.

Optically Tweezing the Colloidal Alphabet, Thomas Mason; Physics and Astronomy, UCLA, USA. Many intricate dielectric shapes having holes and arms, as sampled using lithographic letters that have a thickness and width comparable to the wavelength, can be optically trapped in more than one stable position and orientation.
### Big Sur Room
Bio-Optics: Design and Application (BODA)

### Regency 1 & 2
Novel Techniques in Microscopy (NTM)

### Regency 3
Optical Molecular Probes, Imaging and Drug Delivery (OMP)

### Cypress Room
Optical Trapping Applications (OTA)

#### Wednesday, 6 April 2011
7.30–15.45 Registration Open, Regency Foyer South

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**BWA • Design for Biomedical Optical Imaging**

**Wednesday, 6 April**
8.00–10.00

**President to Be Announced**

**BWA1 • 8.00 Invited**

**Toward Low Cost Imaging: A Laser Scanning Digital Camera,**
*Ann E. Elsner*, Matthew S. Muller, Benno L. Petrig, Joel A. Papay, Christopher A. Clark, Jovan Alavantza, Bryan P. Haggerty; Indiana Univ., USA; *Aeon Imaging*, USA. The laser scanning digital camera is a hybrid confocal imager, designed with simplified optics and electronics to reduce the costs of diagnostic imaging, presentation of visual stimuli, and measurement of refractive error.

**BWA2 • 8.30 Invited**

**Better Medicine Through Proper Lighting,**
*Amber Caipichenski,* Coating, Edmund Optics, USA. Adverse lighting conditions can seriously hinder medical diagnoses. Through the use of properly filtered light, medical professionals may dramatically improve viewing conditions for timely and more accurate diagnoses.

**BWA3 • 9.00**

**Microscopy and Spectroscopy on a Cell Phone,**
*Kaixin Chen*, Zachary J. Smith, Denis Duquette, Dennis Matthews, Stephen Lane, Sebastian Wachsmann-Hogiu; Center for Biophotonics, Univ. of California at Davis, USA; *Dept. of Pathology*, Univ. of California at Davis, USA. We have developed two attachments that transform a cell phone’s integrated camera into either a microscope with 1.5 micron resolution or a spectrometer with a 5nm spectral resolution. We show applications to medically relevant problems.

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**NWA • Endoscopy**

**Wednesday, 6 April**
8.00–10.00

**President to Be Announced**

**NWA1 • 8.00 Invited**

**Scanning Fiber-Optic Nonlinear Endomicroscopy,**
*Kartikeya Murari*, Jiefeng Xi, Ming-ju Lai, Xingde Li, Yuqing Zhang; *Biomedical Engineering*, Johns Hopkins Univ., USA; *Science and Technology Division*, Corning Inc., USA. We present a fully integrated fiber-optic scanning endomicroscope of a probe head weight less than 1.2g. Significant improvements on nonlinear signal collection efficiency (by 30 fold) and resolution (by 2 fold) have been recently achieved.

**NWA2 • 8.30**

**3 mm O.D. Raster Scanning Multiphoton Endoscope,**
*David R. Rivera*, Christopher M. Brown, Chris Xu, Watt W. Webb; Cornell Univ., USA. We present a 3mm outer diameter multiphoton endoscope that utilizes a hybrid resonant/non-resonant miniaturized piezo raster scanner. A field of view of 80um by 70um is achieved at a frame rate of 4.4 frames/s.

**NWA3 • 8.45 Invited**

**Title to Be Announced, Zhongqing Chen; Univ. of California Irvine, USA.**

Abstract not available.

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<td>Big Sur Room</td>
<td>BWA4</td>
<td>Miniaturized Microscope for Multispectral Laser Imaging, Janaka Senaratne; Biomedical Engineering, Johns Hopkins Univ., USA. Imaging setups require stereotaxically affixed animals restricting observable behavior. We present a rodent head-mountable microscope for multi-spectral laser imaging. Architecture and preliminary results are described.</td>
</tr>
<tr>
<td></td>
<td>BWA5</td>
<td>OCT Endomicroscopy and Functional Integration with Two-Photon Fluorescence Imaging, Jiefeng Xi; Kartikeya Murari; Yuying Zhang; Yongqing Chen; Jiaong LF; Xingde Li; Biomedical Engineering, Johns Hopkins Univ., USA. We report on our recent developments of optical coherence tomography endoscopy technologies that enable aberration correction, high-speed uniform data acquisition in Fourier domain, and functional integration with multiphoton fluorescence imaging.</td>
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<td>Regency 1 &amp; 2</td>
<td>NWA4</td>
<td>A Microendoscope with Focal Modulation, Guangjun Gao, Nanguang Chen; Division of Bioengineering, Natl. Univ. of Singapore, Singapore. An endoscope-version focal modulation microscopy (FMM) for in vivo imaging is proposed. Electric optical modulator (EOM)-crystal modulator is used to modulate the beam and a deformable mirror is used for axial scanning.</td>
</tr>
<tr>
<td>Regency 3</td>
<td>NWA5</td>
<td>Invited Title to be Announced, S.H. Andy Yun; Massachusetts General Hospital, USA. Abstract not available.</td>
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10.00–10.30 Coffee Break, Regency Main
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<td>Bio-Optics: Design and Application (BODA)</td>
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<tr>
<td>NWB1 10.30</td>
<td>Technology Development for Multiphoton Imaging, Chris Xu;</td>
<td>Applied and Engineering Physics, Cornell Univ., USA. We present our research effort in improving the penetration depth of multiphoton microscopy and the development of a multiphoton endoscope for imaging intrinsic tissue fluorescence and harmonic generation in vivo.</td>
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<tr>
<td>NWB2 11.00</td>
<td>Title to Be Announced, James V. Jester; Univ. of California Irvine, USA. Abstract not available.</td>
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<tr>
<td>NWB3 11.30</td>
<td>Nonlinear Optical Probes of Ovarian Cancer, Paul J. Campagnola, Molly Brewer, Ronald LaCombr, Oleg Nadiarnykh, Xiyi Chen, Ren-Yu He; Dept. of Biomedical Engineering, Univ. of Wisconsin, USA; Univ. of Connecticut Health Ctr., USA. Nonlinear optics are used to study human ovarian cancer. SHG imaging elucidates structural differences in normal and malignant tissues. Cell adhesion/migration dynamics are examined with ECM models fabricated by multiphoton excited photochemistry.</td>
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<tr>
<td>NWB4 11.45</td>
<td>4-D Image Mapping Spectrometer (IMS) with Structured Illumination, Liang Gao, Noah Bedard, Robert Kester, Nathan Hagen, Tomasz Tuchszczyk; Bioengineering, Rice Univ., USA; Electrical and Computer Engineering, Rice Univ., USA; Rice Quantum Inst., Rice Univ., USA. We present a 4-D (x, y, z, λ) Image Mapping Spectrometer with structured illumination. Depth resolved fluorescence spectral channel images of thick biological tissues were acquired with axial resolution of ~ 1 μm.</td>
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<tr>
<td>Regency 1 &amp; 2</td>
<td>Novel Techniques in Microscopy (NTM)</td>
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<tr>
<td>NWB1 10.30</td>
<td>Invasive Micro-optics for in vivo Imaging in Mouse Brain, Michael J. Levene, Biomedical Engineering, Yale Univ. USA. Invasive micro-optics, including both gradient index lenses and micro-prisms, enable multiphoton microscopy of deep brain structures in vivo that would otherwise be impossible to observe. We present the latest developments in use of micro-optics.</td>
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<tr>
<td>NWB2 11.00</td>
<td>Lensfree Microscopy On a Chip, Aydogan Ozcan; Electrical Engineering Dept., UCLA, USA. We review the recent progress on lensfree on-chip microscopy techniques that are aimed at telemedicine as well as high-throughput biomedical imaging and screening applications.</td>
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<td>Regency 3</td>
<td>Optical Molecular Probes, Imaging and Drug Delivery (OMP)</td>
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<td>NWB3 11.30</td>
<td>Optically Sectioned Fluorescence Imaging with HiLo, Tim N. Ford, Daryl Lim, Kengseh K. Chu, Eladio Rodriguez-Diaz, Satish K. Singh, Jerome Mertz; Biomedical Engineering, Boston Univ., USA; Gastroenterology, Boston Univ. School of Medicine, USA. HiLo is a wide-field fluorescence imaging technique that provides optical sectioning by processing two images acquired sequentially using illumination with and without high contrast structure. We present the latest implementations of the technique.</td>
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<tr>
<td>Cypress Room</td>
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Univ., Huang; Multiplexed BWC

BWB4 • 12.00
Effects of Ultrashort Femtosecond Laser Pulses Upon Embryogenesis of Eukaryotic Organisms, Sergey Arkhipov; 'Chemistry, Michigan State Univ., USA. Using scoring of survival of irradiated Drosophila embryos the moderate effects of fs-laser irradiation on embryogenesis and indirect evidence of possible induction of DNA repair mechanisms are demonstrated.

BWB5 • 12.15
Particle pushing via Liquid Gradient Refractive Index (L-GRIN) Lens, Ahmad A. Nawaz; Xiaole Mao; Yanhui Zhao; Sz-Chin Steven Lin; Tony J. Huang; 'Pennsylvania State Univ., USA. We report an onchip particle manipulator that utilizes a tunable Liquid gradient Refractive Index optofluidic microlens to optically control the pushing the particles. Utilizing the argon laser, particle velocity is controlled via laser input power.

NWB5 • 12.00
Practical Implementation of Log-Scale Active Illumination Microscopy, Kungueh K. Chi; Daryl Lin; Jerome Mertz; 'Biomedical Engineering, Boston Univ., USA. Active illumination microscopy is a method of redistributing dynamic range in scanning microscopes using feedback for real-time control of illumination power. Images are reconstructed on a logarithmic scale to preserve dynamic range benefits.

NWB6 • 12.15
Direct Aberrations Correction in Two Photon Microscopy by a Single On-Axis Measurement, Rodrigo Arèoles-Espinosa; Jordi Andilla; Rafael Porcar-Guzmán; Omar Olarte; Xavier Lozoya; David Artigas; Pablo Lasa-Alvarez; 1Biophotonics, ICFQ – Inst.de Ciències Fotòniques, Spain; 2Imagine Optic, France; 3Dept. of Signal Theory and Communications, Univ. Politécnica de Catalunya, Spain. The use of the nonlinear guide-star concept is proposed. This principle is used to directly measure sample aberrations employing a wave front sensor and correcting them in a single step by shaping a deformable mirror.

BWC • Spectroscopic Imaging

12.30 – 13.30 Lunch Break (on your own)

BWC1 • 13.30
Title to be Announced, Jonas Kollmorgen
Pacific Biosciences, USA. Abstract not available.

BWC2 • 14.00
Title to be Announced, Jerome Hwang;
Biophysics Group, NIST, USA. Abstract not available.

BWC3 • 14.30
Multiplexed Fluorescence Lifetime Image with Fourier Excitation-Emission Spectroscopy, Ming Zhao, Leilei Peng; College of Optical Sciences, Univ. of Arizona, USA. We report a Fourier lifetime microscopic method that measures fluorescence lifetime and intensity excitation-emission matrices in 23 microseconds. The technique will allow fast multiplexed imaging study of Förster resonance energy transfer.

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### BWC • Spectroscopic Imaging—Continued

**BWC1 • 15.00**  
Real-Time Hyperspectral Imaging of Pancreatic β-cell Dynamics with Image Mapping Spectrometer (IMS), Liang Gao1, Amicia Elliott2, Robert Kester1, Nathan Fagert, David Piston1, Tomasz Tkaczyk1;  
1Bioengineering, Rice Univ., USA; 2Department of Molecular Physiology and Biophysics, USA.  
Real-time hyperspectral imaging of pancreatic β-cell dynamics is achieved by utilizing an Image Mapping Spectrometer (IMS). The calcium signal was successfully monitored during caspase-3 mediated FRET in cellular apoptosis.

**BWC5 • 15.15**  
Study of Cationic Polymer/DNA Complex (Polyplex) Formation by Time-Resolved Fluorescence Spectroscopy, Cosima D’Andrea1, Andrea Bassi1, Paola Taroni1, Daniele Pezzoli2, Alessandra Volonterio1, Gabriele Candiani2;  
1Physics, IFN-CNR, IIT, Politecnico di Milano, Italy; 2Dipartimento di Chimica, Materiali e Ingegneria Chimica, Politecnico di Milano, Italy.  
Time-resolved fluorescence spectroscopy of SYBR Green is carried out to characterize cationic polymer/DNA complex (polyplex) formation in solution. Both fluorescence amplitude and lifetime prove to be very sensitive to the Charge Ratio polymer/DNA.

**BWC6 • 15.30**  
Fluorescence Lifetime Imaging Microscopy (FLIM) for Intraoperative Tumor Delineation: A Study in Patients, Yinghua Sun1, Jeremy Meier1, Nisa Hatami1, Jennifer Phipps1, Rudolph J. Schroth1, Brian Potier1, Gregory Farwell1, Daniel Elson1, Laura Marcu1;  
1Dept. of Biomedical Engineering, Univ. of California at Davis, USA; 2School of Medicine, Univ. of California at Davis, USA; 3Inst. of Biomedical Engineering, Imperial College London, UK.  
This work demonstrates a novel application of an endoscopic fluorescence lifetime imaging microscopy system to the intraoperative diagnosis of brain tumor glioblastoma multiforme (GBM) and head&neck tumor squamous cell carcinoma (SCC) in patients.
Key to Authors and Presiders
(Bold denotes Presider or Presenting Author)

Field, Jeffrey-J-NMC5
Fink, Mathias-NTuA3
Fischer, Martin-NMD3
Fleischer, Jason W-NTuC4, NTuC5
Ford, Joseph-BTuA4
Ford, Tim-NWB3
Francis, Tariq-BMC2
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Fung, Kin Hung-OTMA2

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Kim, Seokmin-BMC3
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Kim, Woosung-BMC5
Kitching, John-OTMB3
Klemm, Matthias-OTTuC2
Knoor, Florian-JTuA6
Ko, Kaspar D-OTMA2
Kohl, Anja-BMC4
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Kumar, Anil-OTMA2
Kuo, Shiu-hyang-OMC3
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 Larson, Bjorg A-OTuB6
Le, Hao-OMC7
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Lee, Woei Ming-JTuA31
Lemmer, Uli-NTuC3
Lerosey, Geoffrey-NTuA3
Leveque, Xavier-NWB6
Levene, Michael J-NWB1
Levi, Moshe-OMC2
Lew, Matthew D-NMB2
Lewis, Jim-JTuA1
Li, Guoqiang-BoTuA3
Li, Haowen-NDB2
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Li, Ming-Jun-NWA1
Li, Tongcang-OMB1
Li, Xingde-BWA5, NWA1
Li, Yangguo-OTTuC5
Li, Yichao-BTuC5
Li, Yong-qing-OMC2
Li, Yongbiao-OTTuC6
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Liu, Henry C-NMMD3
Lloyd, William-OMC3
Lo, Yuhwa-BTuA1, BTA4

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Key to Authors and Presiders
(Bold denotes Presider or Presenting Author)

Loloe, Reza-BMD2
Loo, Joachim-JTuA2
Losevsky, Nikolay-JTuA34
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Mckinlay, David-OMTMD6
McNerney, Cory-JTuA10
Medellin, David-OTBM1
Meier, Jeremy-BWC6
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### Key to Authors and Presiders

(Bold denotes Presider or Presenting Author)

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**Location Updates**

Please note the following meeting room updates:

- **BODA Technical Session Room:** Regency 4 - 6, 2nd Floor
- **NTM Technical Session Room:** Regency 1 - 3, 2nd Floor
- **OMP Technical Session Room:** Spyglass 1 – 2, 1st Floor
- **OTA Technical Session Room:** Big Sur 1 - 3, 1st Floor

**Welcome Reception: Beach Grove**

**Exhibits/Coffee Break: Regency Main**

**Presenter Changes**

- Yann Cotte; EPFL, Switzerland will present NTuC2, Holographic Second Harmonic Generation Microscopy.
- V. Karasek; Inst. of Scientific Instruments of the ASCR, Czech Republic will present OTTuC3, Optical Forces near Surface: Full 3-D Finite Element Method Based Calculations.
- S. Koa; EPFL, Switzerland will present JTuA13, Early Glutamate-mediated Cell Death Detection with Digital Holographic Microscopy

**Presider Updates**

- Mary-Ann Mycek; Univ. of Michigan, USA will preside over OMA: Advances in Instrumentation or Algorithms I.

**Withdrawn Presentations**

- OMA5
- OTMA4
- OTMB4
- OTMD4
- OTTuA2
- OTTuC2
- OTTuC5
- JTuA33

**POSTDEADLINE PRESENTATIONS:** Please see the postdeadline papers book for times and locations of postdeadline paper presentations.

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**EXHIBIT GUIDE**

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1101 McKay Drive
San Jose, CA 95131 USA

P: +1 408.512.5928
F: +1 408.512.5929

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**Congratulations to Lihong Wang, the 2011 Mees Medal Recipient.** The medal will be presented during the Welcome Reception.
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1111 Lapierre, Suite 1.855
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POSTDEADLINE PAPERS

Optics in the Life Sciences

Bio-Optics: Design and Application (BODA)
Optical Molecular Probes, Imaging and Drug Delivery (OMP)
Optical Trapping Applications (OTA)

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4–6 April 2011
Hyatt Regency Monterey
Monterey, California, USA
Optics in the Life Sciences Postdeadline Abstracts

• Monday, April 4, 2011 •

OTMD • Trapping with Shaped Beams
Big Sur I-3 (Hyatt)
16:00—18:00
Presider to Be Announced

OTMD4p • 17:00
Enhancement of Optical Gradient Force Employed in Optical Tweezers Using a Pulsed Laser Diode, Takamasa Suzuki1, Takatsugu Maeda2, Osami Sasaki2, Samuel Choi3; 1Niigata Univ., Japan. The optical gradient force employed in optical tweezers is enhanced using a pulsed laser diode. A time-sharing approach can be applied for performing multiple optical manipulations to obtain gentle and stiff tweezers for delicate samples.

OTMD5p • 17:15
Optical Micromanipulation of Red Blood Cells Using a Microfabricated Optical Fiber into Optical Tweezers, Yogeshwar N. Mishra1,2, Nelson Cardenas3, Samarendra K. Mohanty1; 1Physics, Univ. of Texas at Arlington, USA; 2CELOS, Cochin Univ. of Science And Technology, India. We demonstrate the micromanipulation of RBC’s into a tapered fiber-optic trap for the transport into and out of the optical tweezers trap in an orthogonal geometry. We are pursuing high-throughput transport analysis of the RBC’s using this system.

• Tuesday, April 5, 2011 •

OTTuC • Trapping Techniques and Applications III
Big Sur I-3 (Hyatt)
16:00—18:00
Presider to Be Announced

OTTuC2p • 16:30
Free-form optical trapping systems, Andreas Oeder1,2, Sebastian Stoebenau1,2, Stefan Sinzinger1,2; 1Technische Optik, Technische Univ. Ilmenau, Germany; 2IMN MacroNano, Ilmenau, Germany. We report a breakthrough in designing and fabricating free-form trapping systems which opens up a new class of systems for optical micromanipulation. We show 3-D-trapping with a specialized optics (WD=650 µm), which is made of a single piece of PMMA.

OTuD • OMP Postdeadline Session
Big Sur I-3 (Hyatt Regency)
17:15—18:15
Mary-Ann Mycek; Univ. of Michigan, USA, Presider

OTuD1 • 17:15
Sound Light: Model-free Inherently Quantitative Photoacoustic Imaging of Chromophore Concentrations, Wiendelt Steenbergen1, Khalid Daoudi2; 1MIRA Inst. for Biomedical Technology and Technical Medicine, Univ. of Twente, Netherlands. Photoacoustic imaging is made quantitative by adding acousto-optic tagging, following rules for illumination and detection. The theory will be described and computational and experimental validations will be presented, showing virtues and challenges.

OTuD2 • 17:30
Synthesis of Au2S/Au Core/Shell Nanostructures, Joseph Young1, Rebekah Drezek1,2; 1Electrical and Computer Engineering, Rice Univ., USA; 2Bioengineering, Rice Univ., USA. We present a description of the synthesis process that produces pure Au2S cores, with no Au byproducts, followed by the growth of a pure Au shell. NIR Au2S/Au nanoparticles, ~30nm in diameter, have been realized.

OTuD3 • 17:45
Two-photon Imaging of Intracellular Hydrogen Peroxide with a Chemoselective Fluorescence Probe, Hengchang Guo1, Hossein Aleyasin1, Scott Howard2, Bryan C. Dickinson1, Renee Haskew-Layton1, Demirhan Kobal1, Vivian Liu1, David R. Rivera1, Christopher J. Chang1,4, Rajiv J. Ratan1, Chris Xu2; 1Burke Medical Research Inst., Weill Medical College of Cornell Univ., USA; 2School of Applied Physics & Engineering, Cornell Univ., USA; 3Dept. of Chemistry, Univ. of California, USA; 4Howard Hughes Medical Inst., Univ. of California, USA. We present two-photon molecular imaging of hydrogen peroxide production in mouse hippocampal neuronal cells using Peroxyfluor-6 acetoxyethyl ester, a highly sensitive, small-molecule probe for selective imaging of H2O2 within the living cells.
Optics in the Life Sciences Postdeadline Abstracts

• Tuesday, April 5, 2011 •

OTuD4 • 18:00
Characterization of Orthopoxvirus Protein Affinity to Chondroitin Sulfate Using TIRF Microscopy, Jesse Aaron1, Jerilyn Timlin1, Masood Hadi2; 1Dept. Bioenergy and Defense Technologies, Sandia Natl. Labs., USA; 2Biomass Science and Conversion Technology, Sandia Natl. Labs., USA. We investigated the properties of F8L and D8L viral proteins, which mediate viral entry into cells via chondroitin sulfate (CS). We have developed a novel TIRF-based assay to reveal information on binding and nanoscale motility on a CS substrate.

BTuD • BODA Postdeadline Session
Regency 4-6 (Hyatt Regency)
18:15—19:30
Guoqiang Li, Univ. of Missouri at St Louis, USA, Presider

BTuD1 • 18:15
Intraocular Implanted Mirror Telescope for Age Related Macular Degeneration, Isaac Lipshitz1; 1OptoLight Vision Technology, Israel. The implanted mirror telescope magnifies the image that is projected on the retina so that eyes with compromised vision like AMD can detect objects that otherwise they cannot see.

BTuD2 • 17:30
Visual Prosthesis: Recent Development and Future Challenges, Qiushi Ren1; 1College of Engineering, China. Electrical stimulating the different parts of visual pathway for visual recovery had been proposed by many groups. The latest progress and future challenges was presented.

BTuD3 • 18:45
Endogenous Fluorescence Imaging for the Management of Oral and Cervical Cancers, Pierre Lane1, Catherine Poh1,2, Scott Durham2, Lewei Zhang2,4, Sylvia F. Lam1, Miriam Rosin1,4, Michele Follen2, Calum MacAulay1; 1Integrative Oncology, BC Cancer Research Center, Canada; 2Faculty of Dentistry, Univ. of British Columbia, Canada; 3Cancer Control Res., BC Cancer Res. Ctr., Canada; 4Dept. of Pathology, Vancouver General Hospital, Canada; 5Dept. of Otolaryngology, Vancouver General Hospital, Canada; 6Biomedical Physiology and Kinesiology, Simon Fraser Univ., Canada; 7Dept. of Obstetrics and Gynecology, Drexel University, USA.
Imaging of endogenous tissue fluorescence is an effective tool for the early detection of oral and cervical cancers. Recent data show that fluorescence-guided surgical resection of oral lesions dramatically reduce the rate of cancer recurrence.

BTuD4 • 19:00
A Portable System for Imaging and Diffractometry, Khalid M. Arif1,2, Cagri A. Savran1,2, Stefan Sinzinger1,2; 1Mechanical Engineering, Purdue Univ., USA; 2Birck Nanotechnology Center, Purdue Univ., USA. We present the design and development of an all-in-one portable system with embedded computing and data analysis for both imaging and diffractometry. We demonstrate the application of the system to bead-based grating patterns.

BTuD5 • 19:15 p.m.
Cytometry via Optical Wavefront Sensing, James Jacob1, William Sullivan2; John Hoffnagle3,4,CytoRay Inc., USA; 3Univ. of California, Santa Cruz, USA; 4Picarro Inc., USA. We describe a new technique to non-invasively analyze cells. A wavefront sensor measures the aberrations imparted onto a laser that illuminates single cells. The Zernike coefficients of the deformed wavefront comprise a unique cellular signature.
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(Bold denotes Presider or Presenting Author)

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